NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

CLAIMS

[Claim(s)]
[Claim 1]
In said method by which an error which it is how to perform error control of packet switched data, and the 1st portion and the 2nd portion were separated from a packet at least, and was detected with received data is inspected,
A step which determines conditions applied to processing of said 1st portion and the 2nd portion in a situation of an error,
A step to which said conditions confirm whether allow transmitting this 1st portion and/or the 2nd portion to a higher-level protocol layer according to an error detected in said 1st portion and/or the 2nd portion which were received,
How having a step which performs transmission of said 1st portion and/or the 2nd portion in said higher-level protocol layer according to said conditions to which transmission is permitted.
[Claim 2]
A method according to claim 1, wherein said 1st portion comprises a header field and said 2nd portion comprises a pay load.
[Claim 3]
A method according to claim 2 even if said conditions stop said header field transmission to the upper layer of the header FIRU, wherein it is used for compression.
[Claim 4]
A method according to any one of claims 1 to 3, wherein said 1st portion and the 2nd portion are separated from IP data packet which should be transmitted and this 1st portion and the 2nd portion are transmitted by separate logical connection.
[Claim 5]
A method of having further a step which tells an error detected in said 1st portion and/or the 2nd portion of said packet which should be transmitted to said upper layer according to any one of claims 1 to 4.
[Claim 6]
Said 1st portion and a step which conducts an error check about a data unit containing the 2nd portion which were received by the physical layer,
A step which adds an error indication to a mistaken data unit,
A method of having further a step which confirms whether said data unit fulfills said conditions according to any one of claims 1 to 5.
[Claim 7]
In a method according to any one of claims 1 to 6 used for management of radio-resources control protocol RRC of radio resources,
A step which opts for said directions by RRC signaling between a packet radio network and a mobile station,
How to have further a step constituted so that said check may be performed to a data link entity like a PDCP entity or an RLC entity.
[Claim 8]
Said logical connection is processed by RLC entity of a radio-link control layer, and it reaches

by it.
A method of giving a command which directs whether mistaken data should be transmitted to the upper layer to said RLC entity according to any one of claims 4 to 7.
[Claim 9]
Responsibility which a PDCP entity of a packet-data convergence protocol layer separates said 1st portion and/or the 2nd portion, and compounds them is taken, and it reaches.
A method according to any one of claims 1 to 8 characterized by checking said conditions according to display that said 1st portion and/or the 2nd portion of one and the same packet were mistaken.
[Claim 10]
A method according to any one of claims 1 to 9, wherein various conditions are applied to said mobile station rather than a network element which provides said logical connection.
[Claim 11]
In a packet wireless system with which it is constituted so that an error detected by receive-packet switched data may be inspected, and the 1st portion and the 2nd portion are separated from a packet at least,
Said packet wireless system is constituted so that conditions which process an error detected in said 1st portion and the 2nd portion at least may be determined,
According to an error detected in said 1st portion and/or the 2nd portion which were received, it is constituted and said packet wireless system reaches so that said conditions may confirm whether allow transmitting this 1st portion and/or the 2nd portion to a higher-level protocol layer.
A packet wireless system, wherein said packet wireless system is constituted according to said conditions to which transmission is permitted so that said 1st portion and/or the 2nd portion may be transmitted to a higher-level protocol layer.
[Claim 12]
The packet wireless system according to claim 11, wherein said 1st portion comprises a header field and said 2nd portion comprises a pay load.
[Claim 13]
It is constituted and said packet wireless system reaches so that said 1st portion and the 2nd portion may be separated from an IP packet which should be transmitted.
The packet wireless system according to claim 11 or 12, wherein said packet wireless system is constituted so that said 1st portion and the 2nd portion may be transmitted by separate logical connection.
[Claim 14]
In the packet wireless system according to any one of claims 11 to 13 used for management of radio-resources control protocol RRC of radio resources,
It is constituted and a packet radio network of said packet wireless system reaches so that RRC signaling to a mobile station may determine said directions.
A packet wireless system, wherein said mobile station and said packet radio network are constituted so that a data link entity like a PDCP entity or an RLC entity may be ordered to perform said check.
[Claim 15]
In a mobile station with which the 1st portion and the 2nd portion are provided with a means to transmit packet switched data separated from a packet, and a means to detect an error of received data, at least,
A means to determine conditions applied to processing of said 1st portion and the 2nd portion in a situation of an error,
A means by which said conditions confirm whether allow transmitting this 1st portion and/or the 2nd portion to a higher-level protocol layer according to an error detected in said 1st portion and/or the 2nd portion which were received,
A mobile station having further a means to perform transmission of said 1st portion and/or the 2nd portion in said higher-level protocol layer, according to said conditions to which transmission is permitted.

[Claim 16]
In a network element in which the 1st portion and the 2nd portion are provided with a means to transmit packet switched data separated from a packet, and a means to detect an error of received data, at least,
A means to determine conditions applied to processing of said 1st portion and the 2nd portion in a situation of an error,
A means by which said conditions confirm whether allow transmitting this 1st portion and/or the 2nd portion to a higher-level protocol layer according to an error detected in said 1st portion and/or the 2nd portion which were received,
A network element having further a means to perform transmission of said 1st portion and/or the 2nd portion in said higher-level protocol layer, according to said conditions to which transmission is permitted.

[Translation done.]

(19)日本国特許庁(JP)　(12)公表特許公報(A)　(11)特許出願公表番号
特表2004-523947
(P2004-523947A)
(43)公表日　平成16年8月5日(2004.8.5)

(51)Int.Cl.[7]	F I			テーマコード（参考）
H04L 29/10	H04L	13/00	309B	5K014
H04L 1/00	H04L	1/00	B	5K034
H04L 29/08	H04L	13/00	307Z	

審査請求 有　予備審査請求 有　（全 65 頁）

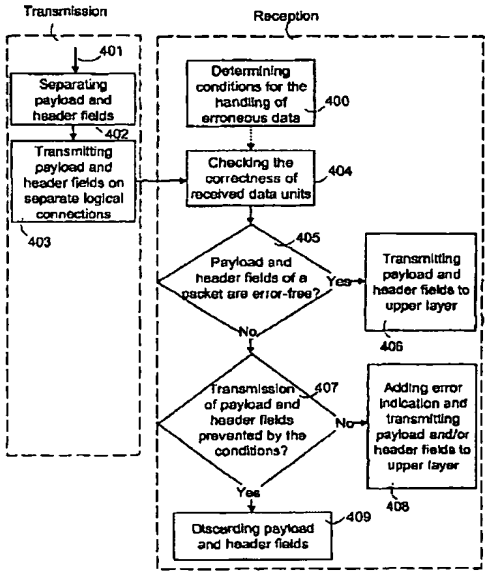
(21)出願番号　特願2002-557069(P2002-557069)
(86)(22)出願日　平成14年1月15日(2002.1.15)
(85)翻訳文提出日　平成15年7月16日(2003.7.16)
(86)国際出願番号　PCT/F12002/000029
(87)国際公開番号　WO2002/056531
(87)国際公開日　平成14年7月18日(2002.7.18)
(31)優先権主張番号　20010098
(32)優先日　平成13年1月16日(2001.1.16)
(33)優先権主張国　フィンランド(FI)

(71)出願人　398012616
ノキア　コーポレイション
フィンランド　エフイーエン－０２１５０
エスプー　ケイララーデンティエ　４
(74)代理人　100099759
弁理士　青木　篤
(74)代理人　100092624
弁理士　鶴田　準一
(74)代理人　100102819
弁理士　島田　哲郎
(74)代理人　100108383
弁理士　下道　晶久
(74)代理人　100082898
弁理士　西山　雅也

最終頁に続く

(54)【発明の名称】パケットが分割されて部分的に処理されるパケット通信システムにおいて誤ったデータを処理するシステム及び方法

(57)【要約】
パケット交換データの誤り制御を行う方法であって、少なくとも第１部分と第２部分がパケットから分離される。この方法では受信データで検出された誤りが検査され、また少なくとも第１部分と第２部分で検出された誤りを処理するための条件が決定される。受信した第１部分と第２部分で誤りが検出された場合、上記条件が第１部分及び／又は第２部分を上位プロトコル層に伝送することを許すかどうかを、ルーチンがチェックする。これが許される場合、第１部分及び／又は第２部分は上位プロトコル層に伝送される。



【特許請求の範囲】
【請求項１】
パケット交換データの誤り制御を行う方法であって、少なくとも第１部分と第２部分がパケットから分離され、かつ受信データで検出された誤りが検査される前記方法において、
誤りの状況で前記第１部分と第２部分の処理に適用する条件を決定するステップと、
受信した前記第１部分及び／又は第２部分で検出された誤りに応じて、前記条件が、該第１部分及び／又は第２部分を上位プロトコル層に伝送することを許すかどうかをチェックするステップと、
伝送を許可する前記条件に応じて、前記上位プロトコル層に前記第１部分及び／又は第２部分の伝送を行うステップと，を有することを特徴とする方法。
【請求項２】
前記第１部分はヘッダフィールドから成り、前記第２部分はペイロードから成ることを特徴とする請求項１に記載の方法。
【請求項３】
前記ヘッダフィールドは、前記条件がそのヘッダフィールの、上位層への伝送を止めたとしても、圧縮に使用されることを特徴とする請求項２に記載の方法。
【請求項４】
前記第１部分と第２部分は伝送すべきＩＰデータパケットから分離され、かつ該第１部分と第２部分は別個の論理接続で伝送されることを特徴とする請求項１～３の何れか一項に記載の方法。
【請求項５】
前記伝送すべきパケットの前記第１部分及び／又は第２部分で検出された誤りを前記上位層へ知らせるステップをさらに有することを特徴とする請求項１～４の何れか一項に記載の方法。
【請求項６】
物理層で受信した、前記第１部分と第２部分を含むデータユニットについて誤り検査を行うステップと、
誤ったデータユニットに誤り表示を付加するステップと、
前記データユニットが前記条件を満たすかどうかをチェックするステップと、をさらに有することを特徴とする請求項１～５の何れか一項に記載の方法。
【請求項７】
無線リソース制御プロトコルＲＲＣが無線リソースの管理のために使用される請求項１～６の何れか一項に記載の方法において、
パケット無線ネットワークと移動局の間のＲＲＣシグナリングにより前記指示を決定するステップと、
ＰＤＣＰエンティティ又はＲＬＣエンティティのようなデータリンクエンティティに前記チェックを行うように構成するステップと、をさらに有する方法。
【請求項８】
無線リンク制御層のＲＬＣエンティティによって前記論理接続が処理され及び
誤ったデータを上位層に伝送すべきかどうかを指示する命令を前記ＲＬＣエンティティに与えることを特徴とする請求項４～７の何れか一項に記載の方法。
【請求項９】
パケットデータコンバージェンスプロトコル層のＰＤＣＰエンティティが前記第１部分及び／又は第２部分を分離し、またそれらを合成する責任を負い及び
１つの及び同じパケットの前記第１部分及び／又は第２部分が誤ったという表示に応じて、前記条件がチェックされることを特徴とする請求項１～８の何れか一項に記載の方法。
【請求項１０】
さまざまな条件が、前記論理接続を提供するネットワーク構成要素よりも前記移動局に適用されることを特徴とする請求項１～９の何れか一項に記載の方法。
【請求項１１】

受信パケット交換データで検出された誤りを検査するように構成されかつ少なくとも第１部分と第２部分がパケットから分離されるパケット無線システムにおいて、
前記パケット無線システムは、少なくとも前記第１部分と第２部分で検出された誤りを処理する条件を決定するように構成され、
前記パケット無線システムは、受信した前記第１部分及び／又は第２部分で検出された誤りに応じて、前記条件が、該第１部分及び／又は第２部分を上位プロトコル層に伝送することを許すかどうかをチェックするように構成され及び
前記パケット無線システムは、伝送を許可する前記条件に応じて、前記第１部分及び／又は第２部分を上位プロトコル層に伝送するように構成されることを特徴とするパケット無線システム。

【請求項１２】
前記第１部分はヘッダフィールドから成り、前記第２部分はペイロードから成ることを特徴とする請求項１１に記載のパケット無線システム。

【請求項１３】
前記パケット無線システムは、伝送すべきＩＰパケットから前記第１部分と第２部分を分離するように構成され及び
前記パケット無線システムは、別個の論理接続で前記第１部分と第２部分を伝送するように構成されることを特徴とする請求項１１又は１２に記載のパケット無線システム。

【請求項１４】
無線リソース制御プロトコルＲＲＣが無線リソースの管理のために使用される請求項１１～１３の何れか一項に記載のパケット無線システムにおいて、
前記パケット無線システムのパケット無線ネットワークは、移動局へのＲＲＣシグナリングにより前記指示を決定するように構成され及び
前記移動局と前記パケット無線ネットワークは、ＰＤＣＰエンティティ又はＲＬＣエンティティのようなデータリンクエンティティに前記チェックの実行を命令するように構成されることを特徴とするパケット無線システム。

【請求項１５】
少なくとも第１部分と第２部分がパケットから分離されるパケット交換データを転送する手段と、受信データの誤りを検出する手段と、を備える移動局において、
誤りの状況で前記第１部分と第２部分の処理に適用する条件を決定する手段と、
受信した前記第１部分及び／又は第２部分で検出された誤りに応じて、前記条件が、該第１部分及び／又は第２部分を上位プロトコル層に伝送することを許すかどうかをチェックする手段と、
伝送を許可する前記条件に応じて、前記上位プロトコル層に前記第１部分及び／又は第２部分の伝送を行う手段と、をさらに備えることを特徴とする移動局。

【請求項１６】
少なくとも第１部分と第２部分がパケットから分離されるパケット交換データを転送する手段と、受信データの誤りを検出する手段と、を備えるネットワーク構成要素において、
誤りの状況で前記第１部分と第２部分の処理に適用する条件を決定する手段と、
受信した前記第１部分及び／又は第２部分で検出された誤りに応じて、前記条件が、該第１部分及び／又は第２部分を上位プロトコル層に伝送することを許すかどうかをチェックする手段と、
伝送を許可する前記条件に応じて、前記上位プロトコル層に前記第１部分及び／又は第２部分の伝送を行う手段と、をさらに備えることを特徴とするネットワーク構成要素。

【発明の詳細な説明】
【技術分野】
【０００１】
本発明は、特にＩＰ（インターネット・プロトコル）パケット伝送におけるデータ誤り検査のやり方と誤ったデータの処理に関する。

【背景技術】

【０００２】
急速に進展しつつあるＩＰ技術は、従来のインターネットデータ転送を超えて多様化したＩＰベースのアプリケーションの利用分野を広げている。ＩＰベースの電話アプリケーションは、特に急速に発展してきており、このため呼の転送経路の増え続ける部分はＩＰ技術を利用して実現可能である。移動通信ネットワークは、ＩＰ技術が多くの利点を供給すると期待される分野を特に形成する。これは、種々のＩＰベースの音声アプリケーションを使用して提供されるであろう従来の音声サービスに加えて、典型的にはパケット交換ＩＰベースサービスとして実現されるのが最も有益である、インターネット閲覧や電子メールサービスのような多様化したデータサービスを移動通信ネットワークは、ますます提供しつつあるからである。従って、移動通信システムのプロトコルに適合するＩＰ層を、オーディオ／ビデオサービスと各種データサービスの両方を提供するのに使用できる。
【０００３】
ＩＰ層はネットワーク層で誤りなしの転送を提供することは保証していないが、転送の信頼度は上位のＴＣＰ（トランスポート制御プロトコル）層で達成される。ＴＣＰはパケットの確認応答と再送に対して責任を負っている。しかし、ＴＣＰは遅延が決定的となるリアルタイムアプリケーションの要件を満足しない。リアルタイムアプリケーションは典型的にはオーディオ及びビデオデータを転送するＵＤＰ（ユーザデータグラムプロトコル）を用いる。ＵＤＰは再送と確認応答のための追加の遅延を何も生じないが、信頼度の高い接続も提供しない。パケット交換ネットワークで伝送されるオーディオ／ビデオフローはパケットに形成されＵＤＰを使用してＲＴＰ（リアルタイムトランスポートプロトコル）により同期がとられる。種々の誤り検査方式が、物理層に対して、特に無線インタフェースで転送されるデータに対して考案されている。よく使用される誤り検査方式は、ＣＲＣ（巡回冗長検査）であり、これは特定のタイプの伝送誤りを検出できる。
【０００４】
本出願では、用語「ペイロード」は使用されるアプリケーションに実質的に役に立つデータに対して用いられ、また「ヘッダーフィールド」はアプリケーションのデータ転送を処理する低位層によりペイロードに付加されるフィールドに対して用いられる。音声アプリケーションでは、ペイロードは、例えば音声サンプルと制御データから成り、ネットワーク層でのヘッダーフィールドは、例えばＲＴＰ，ＵＤＰ及びＩＰヘッダフィールドである。転送すべきデータのペイロードが必要とするものは、特に誤り許容度に関して、ヘッダーフィールドのそれとは異なっている。ヘッダーフィールドでのある誤りは、パケットがヘッダーフィールドの復元(decompress)ではまだ有用かもしれないけれども、そのパケットを正しい受信者に伝送できないということを意味する。これに対して、誤りがペイロードにある場合は、パケットは画像又は音声を生成するリアルタイムアプリケーションに対して多分有用であろう。しかし、誤ったデータパケットは、それが有用であろうとも、典型的には廃棄される。
【発明の開示】
【発明が解決しようとする課題】
【０００５】
従って本発明の目的は上記問題を解決できる方法を提供することである。その方法の目的は独立請求項で述べられていることを特徴とする方法、パケット無線システム，移動局及びネットワーク要素により達成される。本発明の好適実施例は従属請求項に開示されている。
【課題を解決するための手段】
【０００６】
本発明の基礎となる考え方は、少なくとも2つの部分、第１部分と第２部分がパケットから分離されるということ、及び誤りの状況でパケットを処理する条件が決定されるということである。その条件に基づいて、パケットの第１部分及び／又は第２部分を上位層に伝送することが可能かもしれない。
【０００７】

本発明の解決策の利点は、誤りの位置により、パケット又はその部分が異なって処理される場合があるということである。このことはまた、条件でそのように指定されている場合は、誤ったパケットを完全に又は部分的に上位層に伝送することを可能する。

【０００８】

本発明の好適実施例によれば、第１部分はヘッダーフィールドからなり、第２部分はペイロードからなる。これにより，融通の利く条件を、誤りのあるペイロード及び／又はヘッダーフィールドを備えるパケットを処理するために作成することが出来る。さらに、アプリケーションでは、誤ったペイロード、あるいは復元では、誤ったヘッダーフィールドさえも使用することが可能である。

【０００９】

本発明の好適実施例によれば、ＩＰパケットの第１部分は、第２部分とは異なる論理接続で伝送される。これにより誤りが第１部分にあるか第２部分にあるかが容易に検出できる。「論理接続」は、移動局とパケット無線ネットワークとの間のデータ転送のためにデータリンク層Ｌ２により提供される接続を示す。

【００１０】

本発明の更なる実施例によれば、パケット無線ネットワークから移動局にシグナリングする無線リソース制御層により命令が決定される。これの利点は、移動局はどのようにしてパケットを処理すべきか、またそれにより、前よりさらに正確に提供されるべきデータ転送サービスの品質レベルを知るべきかを、ネットワークが決定できるようになることである。

【００１１】

以下に、好適実施例に関して添付図面を参照して本発明を詳細に説明する。

【発明を実施するための最良の形態】

【００１２】

以下に、ＵＭＴＳ（ユニバーサル移動通信システム）とＩＰパケットの転送に関連して一例として本発明を説明する。しかし、本発明はＩＰデータの転送に限定されず、任意のパケット交換通信システムに適用可能である。本発明の方法は、例えば、ＧＥＲＡＮ（ＧＳＭ／ＥＤＧＥ無線アクセスネットワーク）のような第２世代移動通信システムとして周知のシステムの更なる改良のためのプロジェクトに適用されることが有益である。

【００１３】

図1は本発明を説明するのに必須のＵＭＴＳシステムブロックのみを含んでいるが、従来の移動通信システムもまた本明細書で説明する必要のない他の機能や構成要素を含むことが明らかなことは当業者ならわかるであろう。移動通信システムの主要部分は、移動通信システムの固定ネットワークを形成するコアネットワークＣＮとＵＭＴＳ地上無線アクセスネットワークＵＴＲＡＮ、移動局又はユーザー装置ＵＥである。ＣＮとＵＴＲＡＮの間のインタフェースはＩｕと呼ばれ、ＵＴＲＡＮとＵＥの間のインタフェースはＵｕと呼ばれる。

【００１４】

ＵＴＲＡＮは典型的には複数の無線ネットワークサブシステムＲＮＳを備え、サブシステム間のインタフェースはＩｕｒ（図示せず）と呼ばれる。ＲＮＳは1つの無線ネットワークコントローラＲＮＣと1つ以上の、ノードＢとも呼ばれる基地局ＢＳとから成る。ＲＮＣとＢＳの間のインタフェースはＩｕｂと呼ばれる。基地局は典型的には無線経路の実現に責任を負い、無線ネットワークコントローラＲＮＣは少なくとも次のことを管理する。すなわち、無線リソース管理、セル間ハンドオーバ、電力調整、タイミングと同期及びユーザー装置のページングである。

【００１５】

コアネットワークＣＮは、移動通信システムに属しかつＵＴＲＡＮの外部にある基幹施設である。コアネットワークでは，移動交換局／ビジタ位置レジスタ３Ｇ－ＭＳＣ／ＶＬＲがホーム位置レジスタＨＬＲに接続される。またインテリジェントネットワークのサービス制御点ＳＣＰにも接続されることが好ましい。ホーム位置レジスタＨＬＲとビジタ位置

レジスタＶＬＲは移動局に関する情報を備えている。すなわち、ホーム位置レジスタＨＬＲは、移動通信ネットワークの全ての加入者とそれらの加入するサービスに関する情報を備え、またビジタ位置レジスタＶＬＲは，特定の移動交換局ＭＳＣの領域を訪れる移動局に関する情報を備えている。パケット無線システムのサービングノード３Ｇ－ＳＧＳＮ（サービングＧＰＲＳサポートノード）への接続は、インタフェースＧｓ’を介して形成され、固定電話網ＰＳＴＮ／ＩＳＤＮへの接続はゲートウェイ移動交換局ＧＭＳＣ（ゲートウェイＭＳＣ、図示されない）を介して形成される。移動交換局３Ｇ－ＭＳＣ／ＶＬＲとサービングノード３Ｇ－ＳＧＳＮの両方から無線ネットワークＵＴＲＡＮ（ＵＭＴＳ地上無線アクセスネットワーク）への接続はインタフェースＩｕを介して設定される。ＵＭＴＳは、コアネットワークが例えばＧＳＭのコアネットワークと同一でもよいように設計され、この場合には全体のネットワーク基幹施設を再構築する必要は無いということに注意のこと。

【００１６】

従って、ＵＭＴＳは、ＧＳＭネットワークに接続されたＧＰＲＳシステムにより大部分は実現されるパケット無線システムから成り、このことはネットワーク構成要素の名称に関してＧＰＲＳシステムを参照する理由の説明になる。ＵＭＴＳパケット無線システムは、複数のゲートウェイ及びサービングノードを備えてもよく、いくつかのサービングノード３Ｇ－ＳＧＳＮは典型的には１つのゲートウェイノード３Ｇ－ＧＧＳＮに接続される。サービングノード３Ｇ－ＳＧＳＮは，移動局からデータパケットを送信及び受信するため、またそのサービス領域内の移動局の位置を監視するため、パケット無線接続のできる移動局を検出する責任を負っている。さらに、サービングノード３Ｇ－ＳＧＳＮはインタフェースＧｒを介してホーム位置レジスタＨＬＲと接触している。パケット無線サービスに関係しかつ加入者特定パケットデータプロトコルコンテンツを備えるデータレコードもホーム位置レジスタＨＬＲに格納される。

【００１７】

ゲートウェイノード３Ｇ－ＧＧＳＮはＵＭＴＳネットワークパケット無線システムと外部データネットワークＰＤＮ（パケットデータネットワーク）との間のゲートウェイとしての機能を果たす。外部データネットワークとしては、別のネットワークオペレータのＵＭＴＳ又はＧＰＲＳネットワーク、インターネット、Ｘ２５ネットワーク又は私設ローカルエリアネットワークが挙げられる。ゲートウェイノード３Ｇ－ＧＧＳＮはインタフェースＧｉを介して前記データネットワークと通信する。ゲートウェイノード３Ｇ－ＧＧＳＮとサービングノード３Ｇ－ＳＧＳＮの間で伝送されるデータパケットはゲートウェイトンネリングプロトコルＧＴＰにより常にカプセル化される。ゲートウェイノード３Ｇ－ＧＧＳＮはまた、移動局のために起動されたＰＤＰ（パケットデータプロトコル）コンテキストのアドレスと、その経路制御情報すなわち３Ｇ－ＳＧＳＮアドレスも備える。従って、経路制御情報はデータパケットを外部データネットワークとサービングノード３Ｇ－ＳＧＳＮとの間で接続するのに使用される。ゲートウェイノード３Ｇ－ＧＧＳＮとサービングノード３Ｇ－ＳＧＳＮの間のネットワークは、ＩＰプロトコル、好ましくはＩＰｖ６（インターネットプロトコル、バージョン６）を使用する。

【００１８】

図２ａと図２ｂは、ＵＭＴＳにより提供されるパケット無線サービスで制御シグナリング（制御プレーン）とユーザーデータの伝送（ユーザープレーン）に使用されるＵＭＴＳプロトコルスタックを示す。図２ａは移動局ＭＳとコアネットワークＣＮの間の制御シグナリングに使用されるプロトコルスタックを示す。移動局ＭＳの移動管理ＭＭ、呼制御ＣＣ及びセッション管理ＳＭは、移動局ＭＳとコアネットワークＣＮの間で最上位のプロトコル層でシグナリングされるが、これは、それらの間に位置する基地局ＢＳと無線ネットワークコントローラＲＮＣがこのシグナリングにトランスペアレントであるようにして行われる。移動局ＭＳと基地局ＢＳ間の無線リンクの無線リソース管理は無線ネットワークコントローラＲＮＣから基地局ＢＳに制御データを送信する無線リソース管理システムＲＲＭによって実行される。移動通信システムの一般的管理に関連するこれらの機能は、コア

ネットワークプロトコル（ＣＮプロトコル）と呼ばれ、また非アクセス層として知られる１つのグループを形成する。

【００１９】

同様に、移動局ＭＳ、基地局ＢＳ及び無線ネットワークコントローラＲＮＣの間の無線ネットワーク制御に関連するシグナリングは、無線アクセスネットワークプロトコル（ＲＡＮプロトコル）と呼ばれるプロトコル層、すなわちアクセス層で実行される。これらは最下位レベルの転送プロトコルを含むが、その制御シグナリングは、さらなる処理のため上位レベルに転送される。上位アクセス層の最も重要なものは、移動局ＭＳと無線ネットワークＵＴＲＡＮの間の無線リンクを例えば確立，設定，維持及び解放する責任を負い、またコアネットワークＣＮと無線アクセスネットワークＲＡＮから移動局ＭＳに制御情報を送信する責任を負う。さらに、接続が確立又は設定される場合、無線リソース制御プロトコルＲＲＣは無線リソース管理システムＲＲＭの指示により低位レベル１及び２で使用すべきパラメータを決定する。

【００２０】

ＵＭＴＳパケット交換ユーザーデータは図２ｂに示されるプロトコルスタックを使用して伝送される。無線ネットワークＵＴＲＡＮと移動局ＭＳの間のインタフェースＵｕで、物理層Ｌ１の低位レベルのデータ伝送がＷＣＤＭＡ又はＴＤ－ＣＤＭＡプロトコルにより行われる。物理層の上のＭＡＣ層は、物理層とＲＬＣ(無線リンク制御)層の間でデータパケットを伝送し、ＲＬＣ層は様々な論理接続の無線リンクの管理を処理する。ＲＬＣの機能は、例えば、送信するデータを１つ以上のＲＬＣデータパケットへ分割することを含む。ＲＬＣ上部のＰＤＣＤ層のデータパケット（ＰＤＣＰ－ＰＤＵ）のヘッダフィールドはオプションとして圧縮することができる。データパケットは分割されてデータ伝送に必須のアドレス指定及び誤り検出情報を付加されたＲＬＣフレームで伝送される。ＲＬＣ層はＰＤＣＰ層にＱｏＳ（サービス品質）を決定するというオプションを提供し、また確認応答伝送では(別の伝送形態はトランスペアレントな非確認応答伝送である)、損傷したフレームの再送も処理する、すなわち誤り訂正も実行する。ＰＤＣＰ，ＲＬＣ及びＭＡＣはデータリンク層を形成する。サービングノード３Ｇ－ＳＧＳＮは、無線アクセスネットワークＲＡＮを介して移動局ＭＳからくるデータパケットをさらに正しいゲートウエイノード３Ｇ－ＧＧＳＮへと経路制御する責任を負う。この接続は、コアネットワークを介して伝送するために、全てのユーザーデータとシグナリングをカプセル化しかつトンネリングするトンネリングプロトコルＧＴＰを使用する。ＧＴＰプロトコルはコアネットワークによって使用されるＩＰの上で動作する。

【００２１】

論理接続は、典型的には、一方では移動通信ネットワークへのアプリケーション層データフローの伝送を提供するコンバージェンスエンティティに、また他方ではＲＮＣのコンバージェンスエンティティに割当てられ、この論理接続は、ＩＰパケットを物理層に転送するのに使用される。第３世代移動通信システムＵＭＴＳの規格によれば、パケットデータコンバージェンスプロトコル（ＰＤＣＰ）層のエンティティはデータフローを転送する１つの無線リンク制御（ＲＬＣ）層の接続を常に使用する。ＲＬＣ接続、従って論理接続が割当てられている場合、例えば接続のサービスレベルの品質はＲＲＣの指示により選択される。

【００２２】

本発明によれば、少なくとも第１部分と第２部分をパケットから分離できる。受信側で検出された誤りにより、これらの部分を異なって処理できる。本発明の好適実施例によれば、第１部分はヘッダフィールドからなり、第２部分はペイロードからなり、これにより必要な場合には誤ったペイロード又は誤ったヘッダフィールドもまた利用可能となる。以下に述べる実施例では、分割は具体的にはペイロードとヘッダフィールドに基づくが、本発明の範囲はこれに限定されない。分割を行う別の方法、例えば、異なるシグニフィカンス(significance)を有するペイロードビットは異なって処理される部分を形成してもよい。

【００２３】

図３は別個の接続がペイロードとヘッダフィールドに割当てられる、本発明によるシステムのＲＬＣ及びＰＤＣＰ層を示す。ＰＤＰコンテキストそれぞれに、１つのＰＤＣＰエンティティが割当てられる。送信ＰＤＣＰと受信ＰＤＣＰは、送信すべきデータパケットを圧縮し、受信したデータパケットを復元する圧縮器―復元器対を通常含んでいる。各ＰＤＣＰエンティティは１つ以上のヘッダフィールド圧縮アルゴリズムを使用してもよく、あるいは必ずしも何も使用しない。

【００２４】

ＰＤＣＰエンティティは複数のＲＬＣエンティティにマッピングされ、これにより複数の論理接続ＬＣ１－ＬＣ２を１つのＰＤＣＰエンティティに提供できる。個別の論理接続が少なくともペイロードとヘッダフィールドに割当てられることが好ましい。ペイロードとヘッダフィールドは送信すべきＩＰパケットから分離され、圧縮された後、それぞれの論理接続ＬＣ１－ＬＣ２で伝送される。これはＰＤＣＰエンティティがペイロードとヘッダフィールドのための異なる特性のそれぞれの論理接続を使用できるようにする。さらに、ＰＤＣＰは圧縮状態に基づいて、例えば複数の異なる論理接続を使用して、ヘッダフィールドを伝送することができる。ペイロードもまた複数の異なる論理接続を使用して、転送することができる。

【００２５】

図４は、異なる論理接続が、転送されるペイロードとヘッダフィールドの誤りを監視するのに使用される、本発明の好適実施例による方法を示す。上位のコアネットワークプロトコルは、移動局ＵＥとＵＭＴＳネットワークの間のＰＤＰコンテキストを起動する。論理接続はペイロードとヘッダフィールドに割当てられ、関連するパラメータがＲＲＣプロトコルエンティティ間で決定される。ペイロード用に決定されたパラメータはヘッダフィールド用のパラメータとは異なる。例えば、ヘッダフィールド用には、より信頼度の高い接続が割当てられる。

【００２６】

ペイロードとヘッダフィールドで検出された誤りを処理するために、論理接続の割当て期間中に、好ましくはＲＲＣシグナリングにより条件が決定される（４００）。その条件は、誤ったペイロード及び／又はヘッダフィールドを上位プロトコル層に伝送するかどうかを決定する。以下に様々な条件をリストアップするが、本発明の範囲はこれらに限定されない。

１．ヘッダフィールドに誤りがある場合　→　ヘッダフィールド又はペイロードを上位層に伝送しない。

２．ヘッダフィールドに誤りがある場合　→　ヘッダフィールドに誤り表示を与えて伝送しかつペイロードを伝送する。

３．ヘッダフィールドに誤りがある場合　→　ヘッダフィールドに誤り表示を与えて伝送するが、ペイロードは伝送しない。

４．ペイロードに誤りがある場合　→　ヘッダフィールド又はペイロードを伝送しない。

５．ペイロードに誤りがある場合　→　ヘッダフィールドは伝送するが、ペイロードは伝送しない。

６．ペイロードに誤りがある場合　→　ヘッダフィールドとペイロードに誤り表示を与えて伝送する。

７．ヘッダフィールドとペイロードに誤りがある場合　→　ヘッダフィールド又はペイロードを伝送しない。

８．ヘッダフィールドとペイロードに誤りがある場合　→　ヘッダフィールドに誤り表示を与えて伝送するが、ペイロードは伝送しない。

９．ヘッダフィールドとペイロードに誤りがある場合　→　ヘッダフィールドとペイロードに誤り表示を与えて伝送する。

【００２７】

誤り表示はオプションでもよく、これはオプションの数を増加させる。換言すれば、ＲＮ

Ｃから移動局ＵＥへのＲＲＣシグナリングを、特定のデータリンク層で適用すべき条件をシグナリングするのに使用でき、その条件は上記条件１～９であることが好ましい。与えられた条件により、ＲＲＣエンティティは、その条件が満たされるように、ＰＤＣＰエンティティデータ及び／又はＲＬＣエンティティデータの転送に関連したパラメータを設定する。これにより、ネットワークはデータを処理する際に移動局の動作に影響を与えることができる。別の可能な追加の条件は、ペイロード及び／又はヘッダフィールドの上位層への伝送が、適用される圧縮方法に依存するということである。すなわち、例えばＲＯＨＣ（ロバスト（ｒｏｂｕｓｔ）ヘッダ圧縮）を使用して圧縮された誤りのあるパケットは上位層に伝送されるのに対して、ＲＦＣ２５０７により圧縮されたパケットは伝送されない。パケットの上位層への伝送に関する決定が復元の成功に基づいて行われるように条件をさらに指定してもよい。それぞれ特定の場合に適用すべき条件を、例えばアプリケーション又は圧縮の必要性により動的に決定してもよい。必要な場合、例えば使用しているサービスの特性の変更が原因で、論理接続期間中にＲＲＣシグナリングにより条件を変更してもよく、変更される条件はデータリンク層のパラメータを変更することにより実現される。

【００２８】

伝送すべきＩＰパケットが存在する場合（４０１）、伝送すべきパケットのヘッダフィールドとペイロードはコンバージェンスエンティティＰＤＣＰで分離される（４０２）。ヘッダフィールドは、ＩＥＴＦのＲＯＨＣ又はＲＦＣ２５０７によるアルゴリズムのような所定の圧縮アルゴリズムと圧縮コンテキストを使用してヘッダフィールドを圧縮してもよい。ＰＤＣＰはペイロードとヘッダフィールドを、それらに割当てられた論理接続を使用して伝送する。

【００２９】

データの受信時に、誤り検査を受信データについて行う（４０４，４０５）。そのような誤り検査は、任意の方法、例えばＣＲＣを使用して行うことができる。使用の可能性のある、部分的に類似の別の方法としては、チェックサム、パリティチェック及び畳み込み符号化による検査の使用が挙げられる。ＵＭＴＳの場合と同様、データユニットでの誤りを、物理層Ｌ１で行われるＣＲＣに基づいて検出して上位層に知らせてもよい。誤り表示をデータユニットの中に配置してもよく、あるいは別個のリンクでデータユニットに伝送してもよい。１つの及び同じＩＰパケットのヘッダフィールドとペイロードに誤りが無い場合には、それらを上位層に伝送できる（４０６）。ペイロードかヘッダフィールドに誤りが有る場合には、所定（４００）の条件をチェックする。条件が許せば、ペイロード及び／又はヘッダフィールドは上位層に伝送される（４０８）。条件が、ヘッダフィールドとペイロードを廃棄することを指示してもよい（４０９）。換言すれば、誤りが１つの及び同じパケットのペイロードに、あるいはそのヘッダフィールドに又はその両方にあるかどうかによって、適用すべき条件を決定する。例えば、ヘッダフィールドを備えるデータユニットで検出された誤りは、ペイロードを備えかつ同じく廃棄すべき同じＩＰパケットに属する誤りの無いデータユニットを生ずる場合もある。前述のとおり、誤り表示はペイロードとヘッダフィールドを上位層に伝送する前にそれらに付加される。これは、誤ったパケットを、例えばヘッダフィールドの復元やリアルタイムアプリケーションに使用可能とする。条件がヘッダフィールドの上位層への伝送（４０８又は４０９）を止めても、ヘッダフィールドを復元に使用できる。このため条件は別個の、追加の条件で与えられる場合もある。例えば、条件１は、ヘッダフィールドを上位層に伝送せず、廃棄する前に復元に使用すると規定してもよい。

【００３０】

図３とは異なり、ペイロードとヘッダフィールドは分離され（４０２）、ＰＤＣＰ以外の何か他の層の別個の論理接続で伝送されてもよい。例えば、その動作はＲＬＣにより、あるいはＰＤＣＰより上又は下の新しい層で行われてもよい。ペイロードのあるものはヘッダフィールドに割当てられた論理接続を使用して、あるいはこの逆で伝送されるかもしれない。

【００３１】
本発明の好適実施例によれば、ＰＤＣＰ層は誤ったデータユニットを廃棄しかつ所定の条件（４００）によりそれらを上位層に伝送する責任を負う。ＰＤＣＰエンティティの確立に関連して、ＲＲＣエンティティはパラメータを決定して所定の条件を満たすことを可能にする。ＲＬＣ層により提供される論理接続のデータユニットの誤り表示に基づいて、ペイロードを備える、誤ったデータユニットとヘッダフィールドを備える誤ったデータユニットをＰＤＣＰは検出する。例えば，ＰＤＣＰがペイロードで誤りを検出すると、それは同じＩＰパケットに属しているヘッダフィールドで誤り検査を行う。条件が許せば、ペイロードとヘッダフィールドは部分的にあるいは全体的に合成され、そのようにして得られたＩＰパケットは上位層に伝送される。必要な場合、ＰＤＣＰエンティティは取り決めた圧縮アルゴリズムと圧縮コンテキストにより受信したヘッダフィールドを復元する。誤りは、例えばＲＯＨＣによる、ＣＲＣ検査に基づいてＰＤＣＰ層で検出可能であることに注意のこと。

【００３２】
本発明の第２実施例によれば、ＲＬＣ層はデータユニットを廃棄するか又はＲＲＣエンティティによって設定された条件（４００）により上位層に伝送する責任を負う。ヘッダフィールドの転送よりもむしろペイロードの転送が種々のＲＬＣエンティティにより行われるので、ＲＬＣエンティティが誤ったデータユニットを伝送するかどうかをＲＲＣは単に決定できるだけである。条件が許せば、ペイロード及び／又はヘッダフィールドはＰＤＣＰ層に伝送される。ヘッダフィールドとペイロードは合成されて完全なＩＰパケットとして上位レベルに伝送される。条件はヘッダフィールドのＰＤＣＰ層への伝送を規定する（条件３，５及び８）だけかもしれない。これによりＰＤＣＰは次にヘッダフィールドを復元で使用することができる。

【００３３】
本発明の第３実施例によれば、ＰＤＣＰとＲＬＣの両方とも誤ったデータの廃棄か転送に関与する。例えば、ペイロードを備える論理接続に責任を負うＲＬＣエンティティは、誤ったペイロードを廃棄するか又は転送するように構成される。しかし、ＰＤＣＰは、ペイロードに対して利用可能な３つの選択肢（ＲＬＣ層ですでに廃棄か、誤り無しか又は誤ったか）及びヘッダフィールドの正確さに基づいて、ヘッダフィールド及び／又はペイロードの伝送に関して最終決定する場合がある。

【００３４】
図３の場合とは異なり、ＰＤＣＰエンティティのそれぞれに対してただ１つのＲＬＣエンティティが存在するように本発明を実現してもよく、これは図５に示されている。ペイロードとヘッダフィールドは両方とも１つの論理接続を使用して伝送され、次にペイロード及び／又はヘッダフィールドの誤りは上述したのとは異なるあるやり方でローカライズされる。送信ＰＤＣＰエンティティは、伝送すべきＩＰパケットのペイロードとヘッダフィールド間の境界を、さらにもっと下位の層を使用することにより受信ＰＤＣＰエンティティに知らせることが好ましい。復元の成功は、ヘッダフィールドに誤りがあるかどうかを識別しまた関係しているパケットを上位層に伝送すべきかどうかを決定するのに使用されることもまた可能である。ヘッダフィールド及び／又はペイロードで誤りが検出された場合、条件がチェックされ、処理が図４に従って続く（４０５～４０９）。例えば、誤ったとして示されたパケットの復元が成功すれば、誤りはペイロードにあると解釈され、パケットは上位層に伝送される。

【００３５】
本発明の好適実施例によれば、さまざまな条件が、論理接続を提供するＲＬＣよりも移動局に対して決定される。換言すれば、ＲＮＣはそれが指示するもの以外のさまざまな条件をＲＲＣシグナリングを使用してＵＥに適用する。例えば、ヘッダフィールドに誤りがある場合でも、少なくともペイロードは移動局の上位層に伝送すべきであるということを条件は規定するかもしれない。これに反して、ＲＮＣの条件は、ヘッダフィールドに誤りがあるなら、パケット全体の廃棄を必要とする場合がある。このことは、以前よりもよく注

意を必要なパケットの伝送に集中できるが、それは誤ったヘッダフィールドを含むＩＰパケットは他のネットワークに送信する価値は無いが、その反面、誤ったパケットでもＵＥアプリケーションにとっては有用であるからである。

【００３６】

本発明は移動局及び無線ネットワークコントローラＲＮＣのソフトウェアにより、それらのプロセッサ、メモリ及びインタフェースを使用して実現される。ハードウエアの解決策も同様に利用してもよい。

【００３７】

技術の進展につれて、本発明の基本的概念はさまざまな方法で実現できることは当業者には明らかである。例えば、発明の概念は、パケットから第１部分と第２部分を分離できる任意のヘッダ圧縮方法で利用されてもよい。そのようなヘッダ圧縮方法の１つの例はＲＯＨＣである。従って、本発明とその実施例は前述の例に限定されないが、特許請求の範囲内で変わってもよい。

【図面の簡単な説明】

【００３８】

【図１】図１はＵＭＴＳの構成の概略を示すブロック図を示す図である。

【図２ａ】図２ａはＵＭＴＳパケットデータサービスの制御シグナリング及びユーザーデータ伝送のためのプロトコルスタックを示す図である。

【図２ｂ】図２ｂはＵＭＴＳパケットデータサービスの制御シグナリング及びユーザーデータ伝送のためのプロトコルスタックを示す図である。

【図３】図３は本発明の好適実施例によるシステムのＲＬＣ及びＰＤＰＣ層を示す図である。

【図４】図４は本発明の好適実施例による方法を示すフローチャートを示す図である。

【図５】図５は本発明の好適実施例によるシステムのＲＬＣ及びＰＤＰＣ層を示す図である。

【図２ａ】

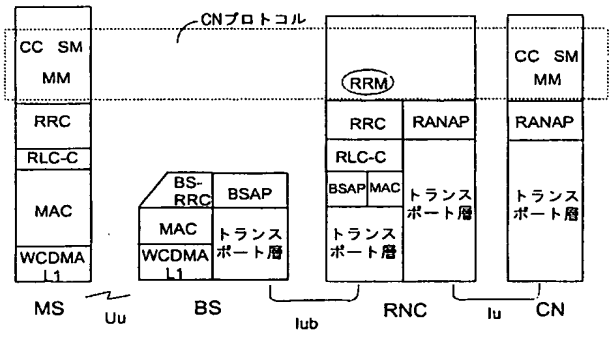


FIG. 2a

【図３】

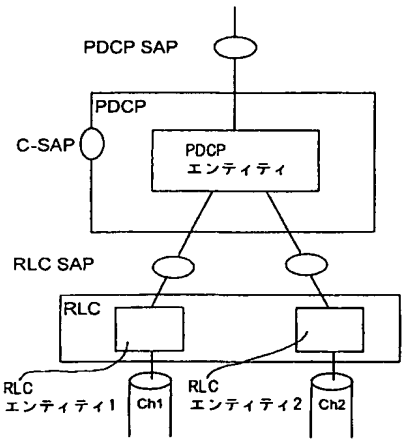


FIG. 3

【図４】

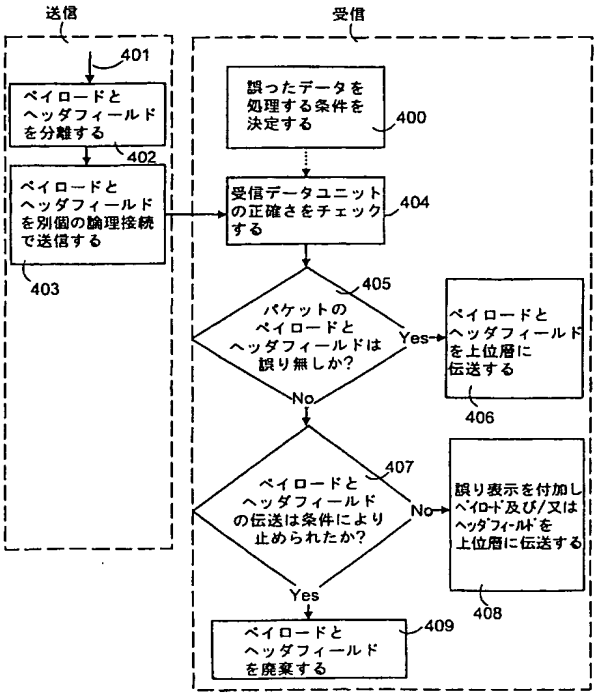


FIG. 4

【図５】

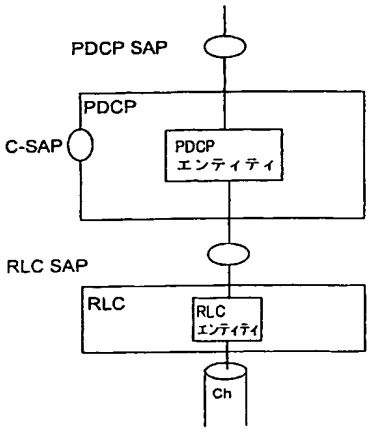


FIG. 5

【国際公開パンフレット】

(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
18 July 2002 (18.07.2002)

PCT

(10) International Publication Number
WO 02/056531 A1

(51) International Patent Classification⁷: H04L 1/00, (H04Q 11/00, H04L 29/06, H03M 13/00)

(21) International Application Number: PCT/FI02/00029

(22) International Filing Date: 15 January 2002 (15.01.2002)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
20010098 16 January 2001 (16.01.2001) FI

(71) Applicant (for all designated States except US): NOKIA CORPORATION [FI/FI]; Keilalahdentie 4, FIN-02150 Espoo (FI).

(72) Inventors; and
(75) Inventors/Applicants (for US only): TOURUNEN, Ari [FI/FI]; Leiliitie 1 D 36, FIN-02230 Espoo (FI). KALLIOKULJU, Juha [FI/FI]; Jokioistentie 5, FIN-37470 Vesilahti (FI).

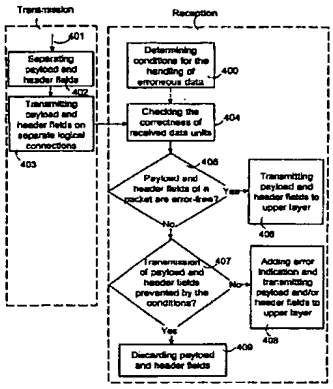
(74) Agent: KOLSTER OY AB; Iso Roobertinkatu 23, P.O. Box 148, FIN-00121 Helsinki (FI).

(81) Designated States (national): AE, AG, AL, AM, AT, AT (utility model), AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, CZ (utility model), DE, DE (utility model), DK, DK (utility model), DM, DZ, EC, EE, EE (utility model), ES, FI, FI (utility model), GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, OM, PH, PL, PT, RO, RU, SD, SE, SG, SI, SK, SK (utility model), SL, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VN, YU, ZA, ZM, ZW.

(84) Designated States (regional): ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM),

[Continued on next page]

(54) Title: SYSTEM AND METHOD FOR PROCESSING OF ERRONEOUS DATA IN PACKET SWITCHED COMMUNICATIONS SYSTEM WHERE THE PACKETS ARE DIVIDED AND PROCESSED IN PARTS



(57) Abstract: A method for arranging error control of packet-switched data, in which method at least a first part and a second part can be separated from the packets. In the method, errors detected in received data are checked, and conditions are determined for handling errors detected at least in the first and the second part. If an error is detected in a received first part and/or second part, the routine checks whether the conditions allow the first part and/or second part to be transmitted to upper protocol layers. If this is allowed, the first part and/or second part are transmitted to upper protocol layers.

WO 02/056531 A1

WO 02/056531 A1

European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Declarations under Rule 4.17:

as to applicant's entitlement to apply for and be granted a patent (Rule 4.17(ii)) for the following designations AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, OM, PH, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TN, TR, TT, TZ, UA, UG, UZ, VN, YU, ZA, ZM, ZW, ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG)

as to the applicant's entitlement to claim the priority of the earlier application (Rule 4.17(iii)) for all designations

Published:

with international search report

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

WO 02/056531 PCT/FI02/00029

SYSTEM AND METHOD FOR PROCESSING OF ERRONEOUS DATA IN PACKET SWITCHED COMMUNICATIONS SYSTEM WHERE THE PACKETS ARE DIVIDED AND PROCESSED IN PARTS

PROCESSING OF ERRONEOUS DATA IN TELECOMMUNICATIONS SYSTEM PROVIDING PACKET-SWITCHED DATA TRANSFER

BACKGROUND OF THE INVENTION

[0001] The invention relates to the arranging of data error check and to the processing of erroneous data, particularly in the transmission of IP (Internet Protocol) packets.

[0002] Rapidly advancing IP technology has expanded the field of use of diverse IP-based applications beyond the conventional Internet data transfer. IP-based telephone applications in particular have developed rapidly, due to which an ever-increasing portion of the transfer path of the calls can be implemented using IP technology. Mobile communications networks in particular form an area where IP technology is anticipated to provide a host of advantages, because in addition to conventional speech services, which could be provided using different IP-based voice applications, mobile communications networks will be increasingly offering diverse data services, such as browsing of the Internet and electronic mail services, which are typically most advantageously produced as packet-switched IP-based services. Hence, IP-layers adapted to the protocols of the mobile communications system could be used for providing both audio/video services and various data services.

[0003] The IP layer is not guaranteed to provide error-free transfer on the network layer, but transfer reliability is achieved on the higher TCP (Transport Control Protocol) layer. TCP is responsible for acknowledging the packets and re-transmitting them. However, TCP does not meet the requirements of real-time applications where delay is critical. Real-time applications typically employ UDP (a User Datagram Protocol) for transferring audio and video data. Although UDP does not cause any additional delay because of re-transmissions and acknowledgements, it does not provide a reliable connection either. The audio/video flows to be carried over a packet-switched network are formed into packets and synchronized by RTP (a Real-time Transport Protocol) using UDP. Diverse error-check methods have been devised for the physical layer, particularly for data to be transferred over the radio interface. An error check method that is often used is CRC (Cyclic Redundancy Check), which allows transmission errors of a specific type to be detected.

[0004] In this application, the term 'payload' is used for data which is substantially useful for the application employed and 'header fields' for fields added into the payload by lower layers taking care of the data transfer of the application. In voice applications, the payload comprises for example voice samples and control data, the header fields on the network layer being for example RTP, UDP and IP header fields. The needs of the payload of the data to be transferred differ from those of the header fields, particularly as regards error tolerance. An error in the header fields would usually mean that the packet could not be transmitted to the correct recipient, although it might still be useful in the decompressing of the header fields. On the other hand, if the error were in the payload, the packet would probably be useful for a real-time application for generating an image or speech. However, erroneous data packets are typically discarded although they might be useful.

BRIEF DESCRIPTION OF THE INVENTION

[0005] It is therefore an object of the invention to provide a method and equipment implementing the method to allow the above-mentioned problems to be avoided. The objects of the method are achieved with a method, packet radio system, a mobile station and a network element characterized by what is stated in the independent claims. The preferred embodiments of the invention are disclosed in the dependent claims.

[0006] The underlying idea of the invention is that at least two parts can be separated from the packets, a first part and a second part, and that conditions are determined for handling them in an error situation. On the basis of the conditions, it may be possible to transmit the first and/or second part of a packet to upper layers.

[0007] An advantage of the solution of the invention is that, depending on the location of the error, the packets, or their parts, may be handled differently. This allows also erroneous packets to be transmitted, entirely or partly, to upper layers when so specified in the conditions.

[0008] According to a preferred embodiment of the invention, the first part comprises header fields and the second part payload. This allows most versatile conditions to be formulated for handling a packet containing erroneous payload and/or header fields. Further, it is possible to use even erroneous payload in the application or erroneous header fields in their decompression.

[0009] According to a preferred embodiment of the invention, the first part of the IP packets is transmitted on different logical connections than the second part. This allows to easily detect whether the error is in the first or the second part. 'Logical connection' refers to the connection provided by a data link layer L2 for the transfer of data between a mobile station and a packet radio network.

[0010] According to a further embodiment of the invention, the instructions are determined by means of radio resource control layer signalling from the packet radio network to the mobile station. An advantage of this is that it allows the network to determine how the mobile station is to handle the packets and thereby to know the level of the quality of the data transfer service to be provided more precisely than before.

BRIEF DESCRIPTION OF THE DRAWINGS

[0011] In the following the invention will be described in greater detail in connection with preferred embodiments and with reference to the accompanying drawings, in which

Figure 1 is a block diagram illustrating a schematic view of the structure of UMTS;

Figures 2a and 2b illustrate protocol stacks of an UMTS packet data service for control signalling and transmission of user data;

Figure 3 illustrates RLC and PDCP layers in a system according to a preferred embodiment of the invention;

Figure 4 is a flow diagram illustrating a method according to a preferred embodiment of the invention; and

Figure 5 illustrates RLC and PDPC layers in a system according to a preferred embodiment of the invention.

DETAILED DESCRIPTION OF THE INVENTION

[0012] In the following, the method of the invention will be described by way of example with reference to UMTS (Universal Mobile Communications System) and transfer of IP packets. However, the invention is not restricted to the transfer of IP data, but can be applied in any packet-switched telecommunications system. The method of the invention can be advantageously applied for example in the projects for the further improvement of what are known as second generation mobile communications systems, such as the GERAN (GSM/Edge Radio Access Network).

[0013] Figure 1 comprises only the UMTS system blocks that are essential for describing the invention, but a person skilled in the art will find it apparent that a conventional mobile communications system also comprises other functions and elements which need not be described in detail herein. The main parts of the mobile communications system are a core network CN and UMTS Terrestrial Radio Access Network UTRAN, which form the fixed network for the mobile communications system, and a mobile station or user equipment UE. The interface between CN and UTRAN is referred to as Iu and the air interface between UTRAN and UE as Uu.

[0014] UTRAN typically comprises a plurality of Radio Network Subsystems RNS, the interface between the subsystems being referred to as Iur (not shown). RNS comprises a Radio Network Controller RNC and one or more base stations BS, which are also referred to as node B. The interface between RNC and BS is referred to as Iub. A base station BS is typically responsible for the radio path implementation, the radio network controller RNC managing at least the following: radio resources management, control of inter-cell handover, power adjustment, timing and synchronization, paging of the user equipment.

[0015] The core network CN is made up of an infrastructure belonging to the mobile communications system and external to UTRAN. In the core network, a Mobile Switching Centre / Visitor Location Register 3G-MSC/VLR is connected to a Home Location Register HLR and preferably also to a Service Control Point SCP of an intelligent network. The home location register HLR and the visitor location register VLR comprise information on mobile subscribers: the home location register HLR comprises information on all subscribers in the mobile communications network and the services they subscribe to, and the visitor location register VLR comprises information on mobile stations visiting the area of a particular mobile switching centre MSC. A connection to a serving node of a packet radio system 3G-SGSN (Serving GPRS Support Node) is formed through interface Gs' and to a fixed telephone network PSTN/ISDN through a gateway mobile switching centre GMSC (Gateway MSC, not shown). The connection from both the mobile switching centre 3G-MSC/VLR and the serving node 3G-SGSN to the radio network UTRAN (UMTS Terrestrial Radio Access Network) is set up through interface Iu. It should be noted that UMTS is designed such that the core network CN

may be identical to the core network of GSM, for example, in which case there is no need to rebuild the entire network infrastructure.

[0016] UMTS thus also comprises a packet radio system which is to a large extent implemented according to a GPRS system connected to a GSM network, which explains the references to a GPRS system in the names of the network elements. The UMTS packet radio system may comprise a plural number of gateway and serving nodes, several serving nodes 3G-SGSN being typically connected to one gateway node 3G-GGSN. The serving node 3G-SGSN is responsible for detecting mobile stations capable of packet radio connections in its service area, for transmitting and receiving data packets from said mobile stations and for monitoring the location of the mobile stations in its service area. Further, the serving node 3G-SGSN is in contact with the home location register HLR through interface Gr. Data records related to the packet radio service and comprising subscriber-specific packet data protocol contents are also stored in the home location register HLR.

[0017] The gateway node 3G-GGSN acts as a gateway between the UMTS network packet radio system and the external data network PDN (Packet Data Network). External data networks include the UMTS or GPRS network of another network operator, the Internet, an X.25 network or a private local area network. The gateway node 3G-GGSN communicates with said data networks through interface Gi. Data packets transmitted between the gateway node 3G-GGSN and the serving node 3G-SGSN are always encapsulated according to the gateway tunneling protocol GTP. The gateway node 3G-GGSN also comprises the addresses of PDP (Packet Data Protocol) contexts activated for the mobile stations, and their routing information, i.e. 3G-SGSN addresses. The routing information is thus used to link the data packets between the external data network and the serving node 3G-SGSN. The network between the gateway node 3G-GGSN and the serving node 3G-SGSN employs an IP protocol, preferably the IPv6 (Internet Protocol, version 6).

[0018] Figures 2a and 2b show UMTS protocol stacks used for control signalling (control plane) and transmission of user data (user plane) in the packet radio service provided by UMTS. Figure 2a shows the protocol stack used for control signalling between the mobile station MS and the core network CN. Mobility management MM, call control CC and session management SM of the mobile station MS are signalled on the highest

protocol layers between the mobile station MS and the core network CN in such a manner that the base stations BS and the radio network controller RNC located in between are transparent to this signalling. The radio resources management of radio links between mobile stations MS and base stations BS is carried out by a radio resource management system RRM which transmits control data from the radio network controller RNC to the base stations BS. These functions associated with the general management of a mobile system form a group called core network protocols (CN protocols), also known as Non-Access Stratum.

[0019] Correspondingly, the signalling related to the radio network control between the mobile station MS, the base station BS and the radio network controller RNC is carried out on protocol layers called radio access network protocols (RAN protocols), i.e. Access Stratum. These include transfer protocols of the lowest level, whose control signalling is transferred to the higher levels for further processing. The most essential one of the higher Access Stratum layers is the radio resource control protocol RRC which is responsible for example for establishing, configuring, maintaining and releasing radio links between the mobile station MS and the radio network UTRAN and for transmitting control information from the core network CN and the radio network RAN to the mobile stations MS. In addition, when a logical connection is to be established or configured, the radio resource control protocol RRC determines the parameters to be used on lower levels 1 and 2 according to the instructions of the radio resources management RRM.

[0020] UMTS packet-switched user data is transmitted using a protocol stack shown in Figure 2b. On interface Uu between the radio network UTRAN and the mobile station MS, lower-level data transmission on physical layer L1 is performed according to a WCDMA or TD-CDMA protocol. A MAC layer above the physical layer transmits data packets between the physical layer and an RLC (Radio Link Control) layer, the RLC layer handling the management of the radio links of different logical connections. The RLC functions comprise for instance segmentation of the data to be transmitted into one or more RLC data packets. The header fields in data packets (PDCP-PDU) of the PDCP layer above RLC can optionally be compressed. The data packets are segmented and transmitted in RLC frames to which addressing and error detection information essential for data transmission is added. The RLC layer offers the PDCP layer the option of determining QoS (Quality of

Service) and, in an acknowledging transmission (other forms of transmission being transparent and non-acknowledging transmissions), it also takes care of re-transmission of damaged frames, i.e. performs error correction. PDCP, RLC and MAC form the data link layer. The serving node 3G-SGSN is responsible for routing data packets coming from the mobile station MS through the radio network RAN further to the correct gateway node 3G-GGSN. This connection uses tunneling protocol GTP which encapsulates and tunnels all user data and signalling to be transmitted through the core network. The GTP protocol runs on top of the IP used by the core network.

[0021] A logical connection is typically allocated to a convergence entity providing transmission of the application layer data flow to the mobile communications network on one hand and to the convergence entity of RNC on the other, the logical connection being used for transferring IP packets to the physical layer. According to the standards of the third generation mobile communications system UMTS, the packet data protocol convergence (PDCP) layer entity always uses one radio link control (RLC) layer connection for transferring a data flow. When the RLC connection, and thereby the logical connection, is being allocated, parameters determining the characteristics of the logical connection, such as the quality of service level of the connection, are selected according to the instructions of RRC.

[0022] According to the invention, at least a first part and a second part can be separated from the packets. Depending on the errors detected at reception, the parts can be processed differently. According to a preferred embodiment of the invention, the first part comprises header fields and the second part payload, which allows erroneous payload or erroneous header fields to be also utilized, when necessary. In the embodiments described below, the division is based specifically on payload and header fields, although the scope of the invention is not restricted thereto. There are also other ways of making the division, for example payload bits having different significance may form parts that are processed differently.

[0023] Figure 3 illustrates RLC and PDCP layers in a system according to a preferred embodiment of the invention in which separate logical connections are allocated for the payload and the header fields. For each PDP context, one PDCP entity is allocated. The sending PDCP and the receiving PDCP usually comprise a compressor-decompressor pair for compressing data packets to be transmitted and for decompressing received data packets.

Each PDCP entity may use one or more header field compression algorithms, or it does not necessarily use any.

[0024] The PDCP entity may be mapped to a plural number of RLC entities, which allows a plural number of logical connections LC1-LC2 to be offered to one PDCP entity. Separate logical connections are preferably allocated at least for payload and header fields. Payload and header fields are separated from the IP packets to be transmitted, and after compression they are transmitted on their respective logical connections LC1-LC2. This allows the PDCP entity to use logical connections LC1-LC2 of different characteristics for the payload and the header fields. Moreover, PDCP can transmit the header fields, on the basis of their compression state, for example, using a plural number of different logical connections. Also payload can be transferred using a plural number of different logical connections.

[0025] Figure 4 illustrates a method according to a preferred embodiment of the invention in which different logical connections are used for monitoring errors in the transferred payload and header fields. The upper core network protocols activate a PDP context between the mobile station UE and the UMTS network. Logical connections are allocated for the payload and the header fields, the related parameters being determined between the RRC protocol entities. The parameters determined for the payload may be different from those of the header fields; for example, a more reliable connection may be allocated for the header fields.

[0026] For the handling of errors detected in the payload and the header fields, conditions are determined 400, preferably by means of RRC signalling, during the allocation of the logical connections. The conditions determine whether erroneous payload and/or header fields are transmitted to the upper protocol layers. Different conditions are listed below, although the scope of the invention is not restricted to them:

1. If there is an error in the header fields → no header fields or payload is transmitted to upper layers.
2. If there is an error in the header fields → the header fields are provided with an error indication and transmitted and the payload is transmitted.
3. If there is an error in the header fields → the header fields are provided with an error indication and transmitted, but the payload is not.

4. If there is an error in the payload → no header fields or payload are transmitted.
5. If there is an error in the payload → the header fields are transmitted, but the payload is not.
6. If there is an error in the payload → the header fields and payload are provided with an error indication and transmitted.
7. If there is an error in the header fields and the payload → no header fields or payload are transmitted.
8. If there is an error in the header fields and payload → the header fields are provided with an error indication and transmitted, but the payload is not.
9. If there is an error in the header fields and payload → the header fields and payload are provided with an error indication and transmitted.

[0027] Error indication may also be optional, which further increases the number of options. In other words, RRC signalling from RNC to mobile station UE can be used for signalling the conditions to be applied on a particular data link layer, the conditions being preferably a combination of the above conditions 1 to 9. According to the conditions provided, the RRC entity sets the parameters associated with the forwarding of the PDCP entity data and/or RLC entity data such that the conditions are met. This allows the network to influence the operation of the mobile station in handling the data. Another possible additional condition is that the transmission of payload and/or header fields to upper layers depends on the compression method applied, i.e. erroneous packets compressed using ROHC (Robust Header Compression), for example, are transmitted to upper layers, whereas packets compressed according to RFC2507 are not. The conditions may be further specified so that the decision about the transmission of a packet to upper layers is made on the basis of the success of the decompression. The conditions to be applied in each particular case may be dynamically determined, according to the needs of the application or the compression, for example. If necessary, the conditions may be changed during the logical connections by means of RRC signalling, due to changes in the characteristics of the service in use, for example, the changed conditions being then implemented by changing the parameters of the data link layer.

[0028] When there are IP packets to be transmitted 401, the header fields and payload of the packet to be transmitted are separated 402 in convergence entity PDCP. The header fields may be compressed using a predetermined compression algorithm, such as ROHC of IETF or an algorithm according to RFC2507, and the compression context. PDCP transmits 403 the payload and the header fields using the logical connections allocated for them.

[0029] At the reception of data, error check is carried out 404, 405 on the received data. The error check as such can be carried out using any method, for example CRC. Other, partly similar error check methods that may be used include the use of a checksum, parity check and a check based on convolution coding. Similarly as in UMTS, errors in a data unit may be detected already on the basis of CRC carried out on physical layer L1 and indicated to upper layers. The error indication may be arranged into the data units, or it may be transmitted to the data unit on a separate link. If there are no errors in the header fields and payload of one and the same IP packet, they can be transmitted 406 to upper layers. If there is an error in the payload or the header fields, the predetermined 400 conditions are checked. If allowed by the conditions, the payload and/or header fields are transmitted 408 to upper layers. The conditions may also prescribe that the header fields and payload are discarded 409. In other words, the conditions to be applied are determined according to whether the error is in the payload of one and the same packet, in its header fields or in both. For example, an error detected in a data unit comprising header fields may cause an error-free data unit comprising payload and belonging to the same IP packet to be discarded as well. As already stated, an error indication is added to the payload and the header fields before they are transmitted to upper layers. This allows also erroneous packets to be used in the decompression of the header fields or in a real-time application, for example. Even though the conditions would prevent the transmission of the header fields to upper layers (408 or 409), they can, however, be used in decompression. For this purpose, the conditions may be provided with a separate, additional condition; for example, condition 1 may prescribe that the header fields are not transmitted to the upper layers, but before they are discarded, they are used for decompression.

[0030] It is to be noted that, unlike in Figure 3, the payload and the header fields may be separated 402 and transmitted on separate logical connections also on some other layer than PDCP. For example, the operation

may be carried out by RLC, or on a new layer above or below PDCP. It is also possible that some of the payload is transmitted using the logical connections allocated for the header fields, or vice versa.

[0031] According to a first preferred embodiment of the invention, the PDCP layer is responsible for discarding erroneous data units and for transmitting them to the upper layers according to the predetermined conditions (400). In connection with the establishment of the PDCP entity, the RRC entity determines parameters for it to allow the predetermined conditions to be met. On the basis of an error indication in the data units of the logical connections provided by the RLC layer, PDCP thus detects erroneous data units comprising payload and those comprising header fields. When PDCP detects an error in the payload, for example, it performs an error check on the header field belonging to the same IP packet. When allowed by the conditions, the payload and the header fields are either partly or completely combined and the IP packet thus obtained is transmitted to upper layers. When necessary, the PDCP entity decompresses the received header fields according to the negotiated compression algorithm and the compression context. It should be noted that errors may be detected in the PDCP layer e.g. on the basis of a CRC check by ROHC.

[0032] According to a second embodiment of the invention, the RLC layer is responsible for discarding the data units or for transmitting them to upper layers according to the conditions (400) set by the RRC entity. Since the transfer of payload is carried out by different RLC entities than that of header fields, RRC can simply determine whether the RLC entities will transmit an erroneous data unit or not. If allowed by the conditions, the payload and/or header fields are transmitted to the PDCP layer. The header fields and payload are combined and transmitted as complete IP packets to higher levels. It is also possible that the conditions only prescribe the transmission of the header fields (conditions 3, 5 and 8) to the PDCP layer, whereby PDCP can then use them in decompression.

[0033] According to a third embodiment of the invention, both PDCP and RLC participate in the discarding or forwarding of erroneous packets. For example, the RLC entity which is responsible for the logical connection comprising payload is arranged to either discard or forward erroneous payload. However, PDCP may make the final decision about the transmission of the header fields and/or payload on the basis of three

alternatives available for payload (already discarded on the RLC layer, error-free or erroneous) and the correctness of the header field.

[0034] Unlike in Figure 3, the invention may also be implemented so that there is only one RLC entity for each PDCP entity, this being shown in Figure 5. The payload and the header fields are both transmitted using one logical connection, an error in the payload and/or the header fields being then localized in some other way than described above. The transmitting PDCP entity preferably indicates to the receiving PDCP entity the border between the payload and the header fields in the IP packets to be transmitted by using layers that may be even further below. It is also possible that the success of the decompression is used for distinguishing whether there is an error in the header fields and for deciding whether the packet concerned is to be transmitted to the upper layers. When an error is detected in the header fields and/or the payload, the conditions are checked and the process continues according to Figure 4 (405-409). For example, if the decompression of a packet indicated as erroneous succeeds, the error is interpreted to have been in the payload and the packet is transmitted to upper layers.

[0035] According to a preferred embodiment of the invention, different conditions are determined for mobile stations than for the RNC providing the logical connections. In other words, RNC may apply different conditions than those it instructs to UE by means of RRC signalling. For example, the conditions may prescribe that at least the payload is to be transmitted to the upper layers in the mobile station even when there is an error in the header field. On the other hand, the conditions of RNC may require the entire packet to be discarded if there is an error in the header field. This allows attention to be focused on the transmission of the necessary packets better than before, because an IP packet containing an erroneous header field is not worth sending to other networks, but, on the other hand, even an erroneous packet may be useful for the UE application.

[0036] The invention may be implemented by software in the mobile station MS and in the radio network controller RNC using their processors, memory and interfaces. Hardware solutions may be used as well.

[0037] It is apparent to a person skilled in the art that as technology advances, the basic idea of the invention can be implemented in various ways. For instance, the inventive concept may be utilized in any header compression method in which a first part and a second part can be separated from the

packets. One example of such header compression method is the ROHC. The invention and its embodiments are therefore not restricted to the above-described examples but they may vary within the scope of the claims.

CLAIMS

1. A method for arranging error control of packet-switched data, in which method at least a first part and a second part can be separated from the packets and in which method errors detected in received data are checked, characterized by comprising the steps of

determining conditions that apply for the processing of the first part and the second part in an error situation;

checking, in response to an error detected in the received first part and/or second part whether said conditions allow the first part and/or second part to be transmitted to upper protocol layers; and

transmitting, in response to said conditions allowing it, the first part and/or second part to the upper protocol layers.

2. A method according to claim 1, characterized in that the first part comprises header fields and the second part payload.

3. A method according to claim 2, characterized in that the header fields are used for decompression, even if said conditions prevented their transmission to upper layers.

4. A method according to any one of the preceding claims, characterized in that the first part and the second part are separated from the IP data packets to be transmitted; and

the first part and the second part are transmitted on separate logical connections.

5. A method according to any one of the preceding claims, characterized by

indicating to the upper layers an error detected in the first part and/or second part of the packets to be transmitted.

6. A method according to any one of the preceding claims, characterized by

performing an error check on data units received on a physical layer and comprising the first part and the second part;

adding an error indication to erroneous data units; and
checking whether said data units meet said conditions.

7. A method according to any one of the preceding claims wherein a radio resource control protocol RRC is used for the management of radio resources, **characterized** by
determining said instructions by means of RRC signalling between the packet radio network and the mobile station; and
arranging a data link layer entity, such as a PDCP entity or an RLC entity to carry out said check.

8. A method according to any one of claims 4 to 7, **characterized** in that
the logical connections are taken care of by the RLC entity of the radio link control layer; and
the RLC entities are provided with a command instructing whether an erroneous data unit is to be transmitted to an upper layer or not.

9. A method according to any one of the preceding claims, **characterized** in that
the PDCP entity of the packet data convergence protocol layer is responsible for separating the first part and the second part and for combining them; and
said conditions are checked in the PDCP entity, in response to an indication that the first part and/or the second part in one and the same packet are erroneous.

10. A method according to any one of the preceding claims, **characterized** in that
different conditions apply for the mobile station than for the network element providing the logical connections.

11. A packet radio system which is arranged to check errors detected in received packet-switched data and in which at least a first part and a second part can be separated from the packets, **characterized** in that

the packet radio system is arranged to determine conditions for the handling of errors detected at least in the first parts and the second parts;

the packet radio system is arranged to check, in response to a detected error in the received first part and/or second part whether said conditions allow the first part and/or second part to be transferred to upper layers; and

the packet radio system is arranged to transmit, in response to said conditions allowing the transmission, the first part and/or second part to upper protocol layers.

12. A packet radio system according to claim 11, **characterized** in that

the first part comprises header fields and the second part payload.

13. A packet radio system according to claim 11 or 12, **characterized** in that

the packet radio system is arranged to separate the first part and the second part from the IP packets to be transmitted; and

the packet radio system is arranged to transmit the first part and the second part on separate logical connections.

14. A packet radio system according to any one of claims 11 to 13, in which system a radio resources control protocol RRC is used for the management of radio resources, **characterized** in that

the packet radio network of the packet radio system is arranged to determine said instructions by means of RRC signalling to the mobile station; and

the mobile station and the packet radio network are arranged to command the data link layer entity, such as the PDCP entity or the RLC entity, to carry out said check.

15. A mobile station comprising:

means for transferring packet-switched data in which at least a first part and a second part can be separated from the packets; and

means for detecting errors in received data, **characterized** in that the mobile station further comprises:

means for determining conditions that apply for the processing of the first part and the second part in an error situation;

means for checking, in response to an error detected in the received first part and/or second part whether said conditions allow the first part and/or second part to be transmitted to upper protocol layers; and

means for transmitting, in response to said conditions allowing it, the first part and/or second part to the upper protocol layers.

16. A network element comprising:

means for transferring packet-switched data in which at least a first part and a second part can be separated from the packets; and

means for detecting errors in received data, **characterized** in that the network element further comprises:

means for determining conditions that apply for the processing of the first part and the second part in an error situation;

means for checking, in response to an error detected in the received first part and/or second part whether said conditions allow the first part and/or second part to be transmitted to upper protocol layers; and

means for transmitting, in response to said conditions allowing it, the first part and/or second part to the upper protocol layers.

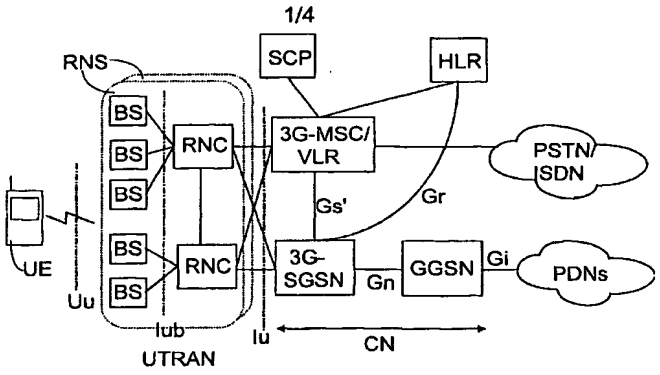

RNS
SCP
HLR
BS
BS
BS
RNC
3G-MSC/
VLR
PSTN/
SDN
Gs'
Gr
UE
BS
BS
RNC
3G-
SGSN
Gn
GGSN
Gi
PDNs
Uu
Iub
Iu
CN
UTRAN

FIG. 1

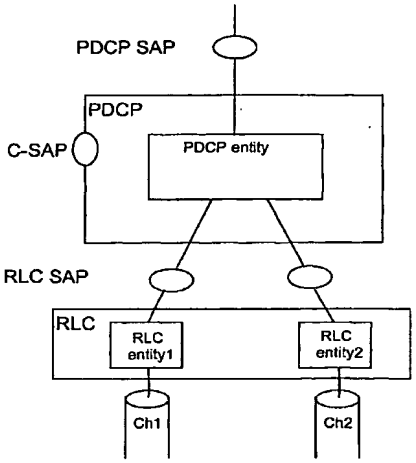

PDCP SAP
PDCP
C-SAP
PDCP entity
RLC SAP
RLC
RLC
entity1
RLC
entity2
Ch1
Ch2

FIG. 3

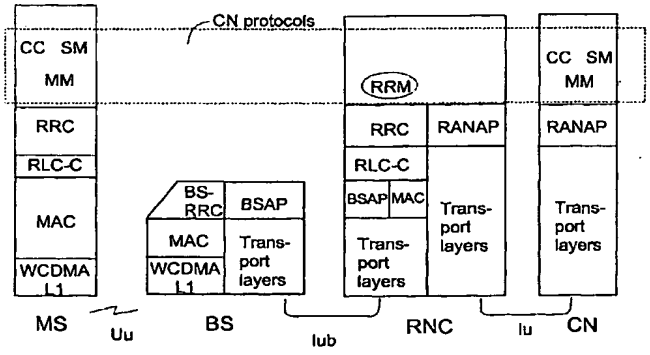

CN protocols
CC SM
MM
RRC
RLC-C
MAC
WCDMA L1
BS-RRC
BSAP
MAC
WCDMA L1
Trans-port layers
RRM
RRC
RANAP
RLC-C
BSAP
MAC
Trans-port layers
Trans-port layers
CC SM
MM
RANAP
Trans-port layers
MS
Uu
BS
Iub
RNC
Iu
CN

FIG. 2a

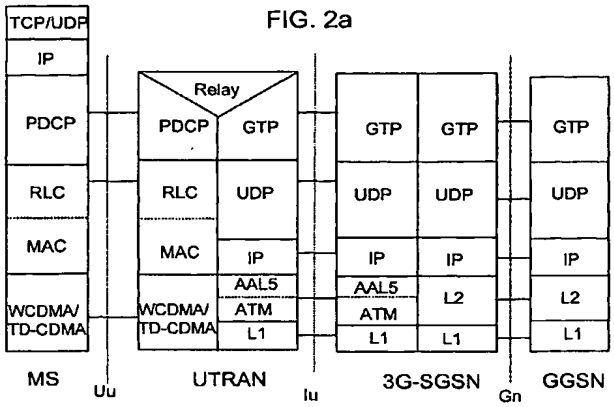

TCP/UDP
IP
PDCP
RLC
MAC
WCDMA/ TD-CDMA
Relay
PDCP
GTP
RLC
UDP
MAC
IP
AAL5
WCDMA/ TD-CDMA
ATM
L1
GTP
GTP
UDP
UDP
IP
IP
AAL5
ATM
L1
L2
L1
GTP
UDP
IP
L2
L1
MS
Uu
UTRAN
Iu
3G-SGSN
Gn
GGSN

FIG. 2b

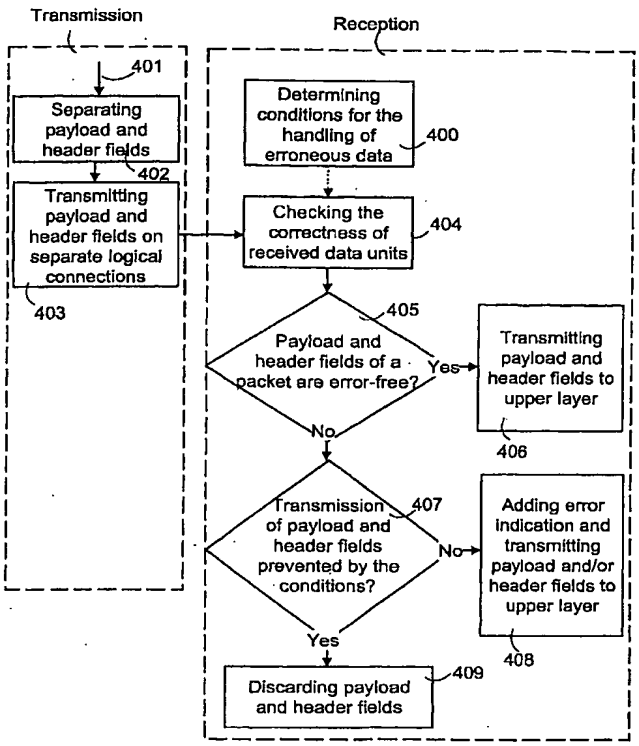

Transmission
Reception
401
Separating payload and header fields
402
Transmitting payload and header fields on separate logical connections
403
Determining conditions for the handling of erroneous data
400
Checking the correctness of received data units
404
405
Payload and header fields of a packet are error-free?
Yes
No
Transmitting payload and header fields to upper layer
406
Transmission of payload and header fields prevented by the conditions?
407
No
Yes
Adding error indication and transmitting payload and/or header fields to upper layer
408
Discarding payload and header fields
409

FIG. 4

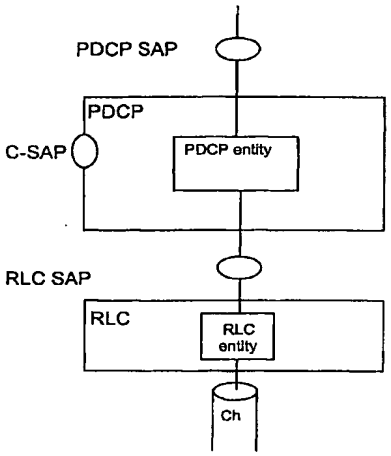


FIG. 5

【国際公開パンフレット（コレクトバージョン）】

(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

CORRECTED VERSION

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
18 July 2002 (18.07.2002)

PCT

(10) International Publication Number
WO 02/056531 A1

(51) International Patent Classification⁷: H04L 1/00, G06F 11/00, H04L 29/06, H03M 13/00

(21) International Application Number: PCT/FI02/00029

(22) International Filing Date: 15 January 2002 (15.01.2002)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
20010098 16 January 2001 (16.01.2001) FI

(71) Applicant (*for all designated States except US*): NOKIA CORPORATION [FI/FI]; Keilalahdentie 4, FIN-02150 Espoo (FI).

(72) Inventors; and

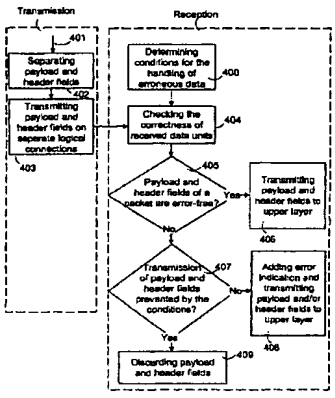
(75) Inventors/Applicants (*for US only*): TOURUNEN, Ari [FI/FI]; Leiltie 1 D 36, FIN-02230 Espoo (FI). KALLIOKULJU, Juha [FI/FI]; Jokioistentie 5, FIN-37470 Vesilahti (FI).

(74) Agent: KOLSTER OY AB; Iso Roobertinkatu 23, P.O. Box 148, FIN-00121 Helsinki (FI).

(81) Designated States (*national*): AE, AG, AL, AM, AT (utility model), AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CO, CR, CU, CZ (utility model), CZ, DE (utility model), DE, DK (utility model), DK, DM, DZ, EC, EE (utility model), EE, ES, FI (utility model), FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, OM, PH, PL, PT, RO, RU, SD,

[Continued on next page]

(54) Title: SYSTEM AND METHOD FOR PROCESSING OF ERRONEOUS DATA IN PACKET SWITCHED COMMUNICATIONS SYSTEM WHERE THE PACKETS ARE DIVIDED AND PROCESSED IN PARTS



(57) Abstract: A method for arranging error control of packet-switched data, in which method at least a first part and a second part can be separated from the packets. In the method, errors detected in received data are checked, and conditions are determined for handling errors detected at least in the first and the second part. If an error is detected in a received first part and/or second part, the routine checks whether the conditions allow the first part and/or second part to be transmitted to upper protocol layers. If this is allowed, the first part and/or second part are transmitted to upper protocol layers.

WO 02/056531 A1

WO 02/056531 A1

SE, SG, SI, SK (utility model), SK, SL, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VN, YU, ZA, ZM, ZW.

(84) **Designated States** *(regional)*: ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Declarations under Rule 4.17:

as to applicant's entitlement to apply for and be granted a patent (Rule 4.17(ii)) for the following designations AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, OM, PH, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TN, TR, TT, TZ, UA, UG, UZ, VN, YU, ZA, ZM, ZW, ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG)

as to the applicant's entitlement to claim the priority of the earlier application (Rule 4.17(iii)) for all designations

Published:

with international search report

(48) **Date of publication of this corrected version:**

5 December 2002

(15) **Information about Correction:**

see PCT Gazette No. 49/2002 of 5 December 2002, Section II

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

WO 02/056531 PCT/FI02/00029

SYSTEM AND METHOD FOR PROCESSING OF ERRONEOUS DATA IN PACKET SWITCHED COMMUNICATIONS SYSTEM WHERE THE PACKETS ARE DIVIDED AND PROCESSED IN PARTS

BACKGROUND OF THE INVENTION

[0001] The invention relates to the arranging of data error check and to the processing of erroneous data, particularly in the transmission of IP (Internet Protocol) packets.

[0002] Rapidly advancing IP technology has expanded the field of use of diverse IP-based applications beyond the conventional Internet data transfer. IP-based telephone applications in particular have developed rapidly, due to which an ever-increasing portion of the transfer path of the calls can be implemented using IP technology. Mobile communications networks in particular form an area where IP technology is anticipated to provide a host of advantages, because in addition to conventional speech services, which could be provided using different IP-based voice applications, mobile communications networks will be increasingly offering diverse data services, such as browsing of the Internet and electronic mail services, which are typically most advantageously produced as packet-switched IP-based services. Hence, IP-layers adapted to the protocols of the mobile communications system could be used for providing both audio/video services and various data services.

[0003] The IP layer is not guaranteed to provide error-free transfer on the network layer, but transfer reliability is achieved on the higher TCP (Transport Control Protocol) layer. TCP is responsible for acknowledging the packets and re-transmitting them. However, TCP does not meet the requirements of real-time applications where delay is critical. Real-time applications typically employ UDP (a User Datagram Protocol) for transferring audio and video data. Although UDP does not cause any additional delay because of re-transmissions and acknowledgements, it does not provide a reliable connection either. The audio/video flows to be carried over a packet-switched network are formed into packets and synchronized by RTP (a Real-time Transport Protocol) using UDP. Diverse error-check methods have been devised for the physical layer, particularly for data to be transferred over the radio interface. An error check method that is often used is CRC (Cyclic Redundancy Check), which allows transmission errors of a specific type to be detected.

[0004] In this application, the term 'payload' is used for data which is substantially useful for the application employed and 'header fields' for fields added into the payload by lower layers taking care of the data transfer of the application. In voice applications, the payload comprises for example voice samples and control data, the header fields on the network layer being for example RTP, UDP and IP header fields. The needs of the payload of the data to be transferred differ from those of the header fields, particularly as regards error tolerance. An error in the header fields would usually mean that the packet could not be transmitted to the correct recipient, although it might still be useful in the decompressing of the header fields. On the other hand, if the error were in the payload, the packet would probably be useful for a real-time application for generating an image or speech. However, erroneous data packets are typically discarded although they might be useful.

BRIEF DESCRIPTION OF THE INVENTION

[0005] It is therefore an object of the invention to provide a method and equipment implementing the method to allow the above-mentioned problems to be avoided. The objects of the method are achieved with a method, packet radio system, a mobile station and a network element characterized by what is stated in the independent claims. The preferred embodiments of the invention are disclosed in the dependent claims.

[0006] The underlying idea of the invention is that at least two parts can be separated from the packets, a first part and a second part, and that conditions are determined for handling them in an error situation. On the basis of the conditions, it may be possible to transmit the first and/or second part of a packet to upper layers.

[0007] An advantage of the solution of the invention is that, depending on the location of the error, the packets, or their parts, may be handled differently. This allows also erroneous packets to be transmitted, entirely or partly, to upper layers when so specified in the conditions.

[0008] According to a preferred embodiment of the invention, the first part comprises header fields and the second part payload. This allows most versatile conditions to be formulated for handling a packet containing erroneous payload and/or header fields. Further, it is possible to use even erroneous payload in the application or erroneous header fields in their decompression.

[0009] According to a preferred embodiment of the invention, the first part of the IP packets is transmitted on different logical connections than the second part. This allows to easily detect whether the error is in the first or the second part. 'Logical connection' refers to the connection provided by a data link layer L2 for the transfer of data between a mobile station and a packet radio network.

[0010] According to a further embodiment of the invention, the instructions are determined by means of radio resource control layer signalling from the packet radio network to the mobile station. An advantage of this is that it allows the network to determine how the mobile station is to handle the packets and thereby to know the level of the quality of the data transfer service to be provided more precisely than before.

BRIEF DESCRIPTION OF THE DRAWINGS

[0011] In the following the invention will be described in greater detail in connection with preferred embodiments and with reference to the accompanying drawings, in which

Figure 1 is a block diagram illustrating a schematic view of the structure of UMTS;

Figures 2a and 2b illustrate protocol stacks of an UMTS packet data service for control signalling and transmission of user data;

Figure 3 illustrates RLC and PDCP layers in a system according to a preferred embodiment of the invention;

Figure 4 is a flow diagram illustrating a method according to a preferred embodiment of the invention; and

Figure 5 illustrates RLC and PDPC layers in a system according to a preferred embodiment of the invention.

DETAILED DESCRIPTION OF THE INVENTION

[0012] In the following, the method of the invention will be described by way of example with reference to UMTS (Universal Mobile Communications System) and transfer of IP packets. However, the invention is not restricted to the transfer of IP data, but can be applied in any packet-switched telecommunications system. The method of the invention can be advantageously applied for example in the projects for the further improvement of what are known as second generation mobile communications systems, such as the GERAN (GSM/Edge Radio Access Network).

[0013] Figure 1 comprises only the UMTS system blocks that are essential for describing the invention, but a person skilled in the art will find it apparent that a conventional mobile communications system also comprises other functions and elements which need not be described in detail herein. The main parts of the mobile communications system are a core network CN and UMTS Terrestrial Radio Access Network UTRAN, which form the fixed network for the mobile communications system, and a mobile station or user equipment UE. The interface between CN and UTRAN is referred to as Iu and the air interface between UTRAN and UE as Uu.

[0014] UTRAN typically comprises a plurality of Radio Network Subsystems RNS, the interface between the subsystems being referred to as Iur (not shown). RNS comprises a Radio Network Controller RNC and one or more base stations BS, which are also referred to as node B. The interface between RNC and BS is referred to as Iub. A base station BS is typically responsible for the radio path implementation, the radio network controller RNC managing at least the following: radio resources management, control of inter-cell handover, power adjustment, timing and synchronization, paging of the user equipment.

[0015] The core network CN is made up of an infrastructure belonging to the mobile communications system and external to UTRAN. In the core network, a Mobile Switching Centre / Visitor Location Register 3G-MSC/VLR is connected to a Home Location Register HLR and preferably also to a Service Control Point SCP of an Intelligent network. The home location register HLR and the visitor location register VLR comprise information on mobile subscribers: the home location register HLR comprises information on all subscribers in the mobile communications network and the services they subscribe to, and the visitor location register VLR comprises information on mobile stations visiting the area of a particular mobile switching centre MSC. A connection to a serving node of a packet radio system 3G-SGSN (Serving GPRS Support Node) is formed through interface Gs' and to a fixed telephone network PSTN/ISDN through a gateway mobile switching centre GMSC (Gateway MSC, not shown). The connection from both the mobile switching centre 3G-MSC/VLR and the serving node 3G-SGSN to the radio network UTRAN (UMTS Terrestrial Radio Access Network) is set up through interface Iu. It should be noted that UMTS is designed such that the core network CN

may be identical to the core network of GSM, for example, in which case there is no need to rebuild the entire network infrastructure.

[0016] UMTS thus also comprises a packet radio system which is to a large extent implemented according to a GPRS system connected to a GSM network, which explains the references to a GPRS system in the names of the network elements. The UMTS packet radio system may comprise a plural number of gateway and serving nodes, several serving nodes 3G-SGSN being typically connected to one gateway node 3G-GGSN. The serving node 3G-SGSN is responsible for detecting mobile stations capable of packet radio connections in its service area, for transmitting and receiving data packets from said mobile stations and for monitoring the location of the mobile stations in its service area. Further, the serving node 3G-SGSN is in contact with the home location register HLR through interface Gr. Data records related to the packet radio service and comprising subscriber-specific packet data protocol contents are also stored in the home location register HLR.

[0017] The gateway node 3G-GGSN acts as a gateway between the UMTS network packet radio system and the external data network PDN (Packet Data Network). External data networks include the UMTS or GPRS network of another network operator, the Internet, an X.25 network or a private local area network. The gateway node 3G-GGSN communicates with said data networks through interface Gi. Data packets transmitted between the gateway node 3G-GGSN and the serving node 3G-SGSN are always encapsulated according to the gateway tunneling protocol GTP. The gateway node 3G-GGSN also comprises the addresses of PDP (Packet Data Protocol) contexts activated for the mobile stations, and their routing information, i.e. 3G-SGSN addresses. The routing information is thus used to link the data packets between the external data network and the serving node 3G-SGSN. The network between the gateway node 3G-GGSN and the serving node 3G-SGSN employs an IP protocol, preferably the IPv6 (Internet Protocol, version 6).

[0018] Figures 2a and 2b show UMTS protocol stacks used for control signalling (control plane) and transmission of user data (user plane) in the packet radio service provided by UMTS. Figure 2a shows the protocol stack used for control signalling between the mobile station MS and the core network CN. Mobility management MM, call control CC and session management SM of the mobile station MS are signalled on the highest

protocol layers between the mobile station MS and the core network CN in such a manner that the base stations BS and the radio network controller RNC located in between are transparent to this signalling. The radio resources management of radio links between mobile stations MS and base stations BS is carried out by a radio resource management system RRM which transmits control data from the radio network controller RNC to the base stations BS. These functions associated with the general management of a mobile system form a group called core network protocols (CN protocols), also known as Non-Access Stratum.

[0019] Correspondingly, the signalling related to the radio network control between the mobile station MS, the base station BS and the radio network controller RNC is carried out on protocol layers called radio access network protocols (RAN protocols), i.e. Access Stratum. These include transfer protocols of the lowest level, whose control signalling is transferred to the higher levels for further processing. The most essential one of the higher Access Stratum layers is the radio resource control protocol RRC which is responsible for example for establishing, configuring, maintaining and releasing radio links between the mobile station MS and the radio network UTRAN and for transmitting control information from the core network CN and the radio network RAN to the mobile stations MS. In addition, when a logical connection is to be established or configured, the radio resource control protocol RRC determines the parameters to be used on lower levels 1 and 2 according to the instructions of the radio resources management RRM.

[0020] UMTS packet-switched user data is transmitted using a protocol stack shown in Figure 2b. On interface Uu between the radio network UTRAN and the mobile station MS, lower-level data transmission on physical layer L1 is performed according to a WCDMA or TD-CDMA protocol. A MAC layer above the physical layer transmits data packets between the physical layer and an RLC (Radio Link Control) layer, the RLC layer handling the management of the radio links of different logical connections. The RLC functions comprise for instance segmentation of the data to be transmitted into one or more RLC data packets. The header fields in data packets (PDCP-PDU) of the PDCP layer above RLC can optionally be compressed. The data packets are segmented and transmitted in RLC frames to which addressing and error detection information essential for data transmission is added. The RLC layer offers the PDCP layer the option of determining QoS (Quality of

Service) and, in an acknowledging transmission (other forms of transmission being transparent and non-acknowledging transmissions), it also takes care of re-transmission of damaged frames, i.e. performs error correction. PDCP, RLC and MAC form the data link layer. The serving node 3G-SGSN is responsible for routing data packets coming from the mobile station MS through the radio network RAN further to the correct gateway node 3G-GGSN. This connection uses tunneling protocol GTP which encapsulates and tunnels all user data and signalling to be transmitted through the core network. The GTP protocol runs on top of the IP used by the core network.

[0021] A logical connection is typically allocated to a convergence entity providing transmission of the application layer data flow to the mobile communications network on one hand and to the convergence entity of RNC on the other, the logical connection being used for transferring IP packets to the physical layer. According to the standards of the third generation mobile communications system UMTS, the packet data protocol convergence (PDCP) layer entity always uses one radio link control (RLC) layer connection for transferring a data flow. When the RLC connection, and thereby the logical connection, is being allocated, parameters determining the characteristics of the logical connection, such as the quality of service level of the connection, are selected according to the instructions of RRC.

[0022] According to the invention, at least a first part and a second part can be separated from the packets. Depending on the errors detected at reception, the parts can be processed differently. According to a preferred embodiment of the invention, the first part comprises header fields and the second part payload, which allows erroneous payload or erroneous header fields to be also utilized, when necessary. In the embodiments described below, the division is based specifically on payload and header fields, although the scope of the invention is not restricted thereto. There are also other ways of making the division, for example payload bits having different significance may form parts that are processed differently.

[0023] Figure 3 illustrates RLC and PDCP layers in a system according to a preferred embodiment of the invention in which separate logical connections are allocated for the payload and the header fields. For each PDP context, one PDCP entity is allocated. The sending PDCP and the receiving PDCP usually comprise a compressor-decompressor pair for compressing data packets to be transmitted and for decompressing received data packets.

Each PDCP entity may use one or more header field compression algorithms, or it does not necessarily use any.

[0024] The PDCP entity may be mapped to a plural number of RLC entities, which allows a plural number of logical connections LC1-LC2 to be offered to one PDCP entity. Separate logical connections are preferably allocated at least for payload and header fields. Payload and header fields are separated from the IP packets to be transmitted, and after compression they are transmitted on their respective logical connections LC1-LC2. This allows the PDCP entity to use logical connections LC1-LC2 of different characteristics for the payload and the header fields. Moreover, PDCP can transmit the header fields, on the basis of their compression state, for example, using a plural number of different logical connections. Also payload can be transferred using a plural number of different logical connections.

[0025] Figure 4 illustrates a method according to a preferred embodiment of the invention in which different logical connections are used for monitoring errors in the transferred payload and header fields. The upper core network protocols activate a PDP context between the mobile station UE and the UMTS network. Logical connections are allocated for the payload and the header fields, the related parameters being determined between the RRC protocol entities. The parameters determined for the payload may be different from those of the header fields; for example, a more reliable connection may be allocated for the header fields.

[0026] For the handling of errors detected in the payload and the header fields, conditions are determined 400, preferably by means of RRC signalling, during the allocation of the logical connections. The conditions determine whether erroneous payload and/or header fields are transmitted to the upper protocol layers. Different conditions are listed below, although the scope of the invention is not restricted to them:

1. If there is an error in the header fields → no header fields or payload is transmitted to upper layers.
2. If there is an error in the header fields → the header fields are provided with an error indication and transmitted and the payload is transmitted.
3. If there is an error in the header fields → the header fields are provided with an error indication and transmitted, but the payload is not.

4. If there is an error in the payload → no header fields or payload are transmitted.
5. If there is an error in the payload → the header fields are transmitted, but the payload is not.
6. If there is an error in the payload → the header fields and payload are provided with an error indication and transmitted.
7. If there is an error in the header fields and the payload → no header fields or payload are transmitted.
8. If there is an error in the header fields and payload → the header fields are provided with an error indication and transmitted, but the payload is not.
9. If there is an error in the header fields and payload → the header fields and payload are provided with an error indication and transmitted.

[0027] Error indication may also be optional, which further increases the number of options. In other words, RRC signalling from RNC to mobile station UE can be used for signalling the conditions to be applied on a particular data link layer, the conditions being preferably a combination of the above conditions 1 to 9. According to the conditions provided, the RRC entity sets the parameters associated with the forwarding of the PDCP entity data and/or RLC entity data such that the conditions are met. This allows the network to influence the operation of the mobile station in handling the data. Another possible additional condition is that the transmission of payload and/or header fields to upper layers depends on the compression method applied, i.e. erroneous packets compressed using ROHC (Robust Header Compression), for example, are transmitted to upper layers, whereas packets compressed according to RFC2507 are not. The conditions may be further specified so that the decision about the transmission of a packet to upper layers is made on the basis of the success of the decompression. The conditions to be applied in each particular case may be dynamically determined, according to the needs of the application or the compression, for example. If necessary, the conditions may be changed during the logical connections by means of RRC signalling, due to changes in the characteristics of the service in use, for example, the changed conditions being then implemented by changing the parameters of the data link layer.

[0028] When there are IP packets to be transmitted 401, the header fields and payload of the packet to be transmitted are separated 402 in convergence entity PDCP. The header fields may be compressed using a predetermined compression algorithm, such as ROHC of IETF or an algorithm according to RFC2507, and the compression context. PDCP transmits 403 the payload and the header fields using the logical connections allocated for them.

[0029] At the reception of data, error check is carried out 404, 405 on the received data. The error check as such can be carried out using any method, for example CRC. Other, partly similar error check methods that may be used include the use of a checksum, parity check and a check based on convolution coding. Similarly as in UMTS, errors in a data unit may be detected already on the basis of CRC carried out on physical layer L1 and indicated to upper layers. The error indication may be arranged into the data units, or it may be transmitted to the data unit on a separate link. If there are no errors in the header fields and payload of one and the same IP packet, they can be transmitted 406 to upper layers. If there is an error in the payload or the header fields, the predetermined 400 conditions are checked. If allowed by the conditions, the payload and/or header fields are transmitted 408 to upper layers. The conditions may also prescribe that the header fields and payload are discarded 409. In other words, the conditions to be applied are determined according to whether the error is in the payload of one and the same packet, in its header fields or in both. For example, an error detected in a data unit comprising header fields may cause an error-free data unit comprising payload and belonging to the same IP packet to be discarded as well. As already stated, an error indication is added to the payload and the header fields before they are transmitted to upper layers. This allows also erroneous packets to be used in the decompression of the header fields or in a real-time application, for example. Even though the conditions would prevent the transmission of the header fields to upper layers (408 or 409), they can, however, be used in decompression. For this purpose, the conditions may be provided with a separate, additional condition; for example, condition 1 may prescribe that the header fields are not transmitted to the upper layers, but before they are discarded, they are used for decompression.

[0030] It is to be noted that, unlike in Figure 3, the payload and the header fields may be separated 402 and transmitted on separate logical connections also on some other layer than PDCP. For example, the operation

may be carried out by RLC, or on a new layer above or below PDCP. It is also possible that some of the payload is transmitted using the logical connections allocated for the header fields, or vice versa.

[0031] According to a first preferred embodiment of the invention, the PDCP layer is responsible for discarding erroneous data units and for transmitting them to the upper layers according to the predetermined conditions (400). In connection with the establishment of the PDCP entity, the RRC entity determines parameters for it to allow the predetermined conditions to be met. On the basis of an error indication in the data units of the logical connections provided by the RLC layer, PDCP thus detects erroneous data units comprising payload and those comprising header fields. When PDCP detects an error in the payload, for example, it performs an error check on the header field belonging to the same IP packet. When allowed by the conditions, the payload and the header fields are either partly or completely combined and the IP packet thus obtained is transmitted to upper layers. When necessary, the PDCP entity decompresses the received header fields according to the negotiated compression algorithm and the compression context. It should be noted that errors may be detected in the PDCP layer e.g. on the basis of a CRC check by ROHC.

[0032] According to a second embodiment of the invention, the RLC layer is responsible for discarding the data units or for transmitting them to upper layers according to the conditions (400) set by the RRC entity. Since the transfer of payload is carried out by different RLC entities than that of header fields, RRC can simply determine whether the RLC entities will transmit an erroneous data unit or not. If allowed by the conditions, the payload and/or header fields are transmitted to the PDCP layer. The header fields and payload are combined and transmitted as complete IP packets to higher levels. It is also possible that the conditions only prescribe the transmission of the header fields (conditions 3, 5 and 8) to the PDCP layer, whereby PDCP can then use them in decompression.

[0033] According to a third embodiment of the invention, both PDCP and RLC participate in the discarding or forwarding of erroneous packets. For example, the RLC entity which is responsible for the logical connection comprising payload is arranged to either discard or forward erroneous payload. However, PDCP may make the final decision about the transmission of the header fields and/or payload on the basis of three

alternatives available for payload (already discarded on the RLC layer, error-free or erroneous) and the correctness of the header field.

[0034] Unlike in Figure 3, the invention may also be implemented so that there is only one RLC entity for each PDCP entity, this being shown in Figure 5. The payload and the header fields are both transmitted using one logical connection, an error in the payload and/or the header fields being then localized in some other way than described above. The transmitting PDCP entity preferably indicates to the receiving PDCP entity the border between the payload and the header fields in the IP packets to be transmitted by using layers that may be even further below. It is also possible that the success of the decompression is used for distinguishing whether there is an error in the header fields and for deciding whether the packet concerned is to be transmitted to the upper layers. When an error is detected in the header fields and/or the payload, the conditions are checked and the process continues according to Figure 4 (405-409). For example, if the decompression of a packet indicated as erroneous succeeds, the error is interpreted to have been in the payload and the packet is transmitted to upper layers.

[0035] According to a preferred embodiment of the invention, different conditions are determined for mobile stations than for the RNC providing the logical connections. In other words, RNC may apply different conditions than those it instructs to UE by means of RRC signalling. For example, the conditions may prescribe that at least the payload is to be transmitted to the upper layers in the mobile station even when there is an error in the header field. On the other hand, the conditions of RNC may require the entire packet to be discarded if there is an error in the header field. This allows attention to be focused on the transmission of the necessary packets better than before, because an IP packet containing an erroneous header field is not worth sending to other networks, but, on the other hand, even an erroneous packet may be useful for the UE application.

[0036] The invention may be implemented by software in the mobile station MS and in the radio network controller RNC using their processors, memory and interfaces. Hardware solutions may be used as well.

[0037] It is apparent to a person skilled in the art that as technology advances, the basic idea of the invention can be implemented in various ways. For instance, the inventive concept may be utilized in any header compression method in which a first part and a second part can be separated from the

packets. One example of such header compression method is the ROHC. The invention and its embodiments are therefore not restricted to the above-described examples but they may vary within the scope of the claims.

CLAIMS

1. A method for arranging error control of packet-switched data, in which method at least a first part and a second part can be separated from the packets and in which method errors detected in received data are checked, **characterized** by comprising the steps of

determining conditions that apply for the processing of the first part and the second part in an error situation;

checking, in response to an error detected in the received first part and/or second part whether said conditions allow the first part and/or second part to be transmitted to upper protocol layers; and

transmitting, in response to said conditions allowing it, the first part and/or second part to the upper protocol layers.

2. A method according to claim 1, **characterized** in that the first part comprises header fields and the second part payload.

3. A method according to claim 2, **characterized** in that the header fields are used for decompression, even if said conditions prevented their transmission to upper layers.

4. A method according to any one of the preceding claims, **characterized** in that the first part and the second part are separated from the IP data packets to be transmitted; and

the first part and the second part are transmitted on separate logical connections.

5. A method according to any one of the preceding claims, **characterized** by

indicating to the upper layers an error detected in the first part and/or second part of the packets to be transmitted.

6. A method according to any one of the preceding claims, **characterized** by

performing an error check on data units received on a physical layer and comprising the first part and the second part;

adding an error indication to erroneous data units; and
checking whether said data units meet said conditions.

7. A method according to any one of the preceding claims wherein a radio resource control protocol RRC is used for the management of radio resources, **characterized** by
determining said instructions by means of RRC signalling between the packet radio network and the mobile station; and
arranging a data link layer entity, such as a PDCP entity or an RLC entity to carry out said check.

8. A method according to any one of claims 4 to 7, **characterized** in that
the logical connections are taken care of by the RLC entity of the radio link control layer; and
the RLC entities are provided with a command instructing whether an erroneous data unit is to be transmitted to an upper layer or not.

9. A method according to any one of the preceding claims, **characterized** in that
the PDCP entity of the packet data convergence protocol layer is responsible for separating the first part and the second part and for combining them; and
said conditions are checked in the PDCP entity, in response to an indication that the first part and/or the second part in one and the same packet are erroneous.

10. A method according to any one of the preceding claims, **characterized** in that
different conditions apply for the mobile station than for the network element providing the logical connections.

11. A packet radio system which is arranged to check errors detected in received packet-switched data and in which at least a first part and a second part can be separated from the packets, **characterized** in that

the packet radio system is arranged to determine conditions for the handling of errors detected at least in the first parts and the second parts;

the packet radio system is arranged to check, in response to a detected error in the received first part and/or second part whether said conditions allow the first part and/or second part to be transferred to upper layers; and

the packet radio system is arranged to transmit, in response to said conditions allowing the transmission, the first part and/or second part to upper protocol layers.

12. A packet radio system according to claim 11, **characterized** in that

the first part comprises header fields and the second part payload.

13. A packet radio system according to claim 11 or 12, **characterized** in that

the packet radio system is arranged to separate the first part and the second part from the IP packets to be transmitted; and

the packet radio system is arranged to transmit the first part and the second part on separate logical connections.

14. A packet radio system according to any one of claims 11 to 13, in which system a radio resources control protocol RRC is used for the management of radio resources, **characterized** in that

the packet radio network of the packet radio system is arranged to determine said instructions by means of RRC signalling to the mobile station; and

the mobile station and the packet radio network are arranged to command the data link layer entity, such as the PDCP entity or the RLC entity, to carry out said check.

15. A mobile station comprising:

means for transferring packet-switched data in which at least a first part and a second part can be separated from the packets; and

means for detecting errors in received data, **characterized** in that the mobile station further comprises:

means for determining conditions that apply for the processing of the first part and the second part in an error situation;

means for checking, in response to an error detected in the received first part and/or second part whether said conditions allow the first part and/or second part to be transmitted to upper protocol layers; and

means for transmitting, in response to said conditions allowing it, the first part and/or second part to the upper protocol layers.

16. A network element comprising:

means for transferring packet-switched data in which at least a first part and a second part can be separated from the packets; and

means for detecting errors in received data, **characterized** in that the network element further comprises:

means for determining conditions that apply for the processing of the first part and the second part in an error situation;

means for checking, in response to an error detected in the received first part and/or second part whether said conditions allow the first part and/or second part to be transmitted to upper protocol layers; and

means for transmitting, in response to said conditions allowing it, the first part and/or second part to the upper protocol layers.

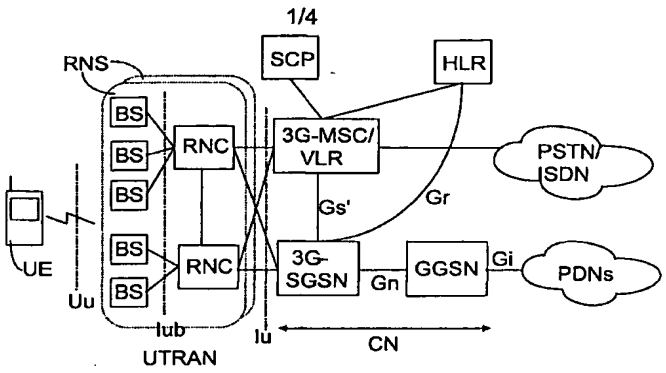

RNS
SCP
HLR
BS
BS
BS
RNC
3G-MSC/
VLR
PSTN/
ISDN
Gs'
Gr
UE
BS
BS
RNC
3G-
SGSN
Gn
GGSN
Gi
PDNs
Uu
Iub
Iu
CN
UTRAN

FIG. 1

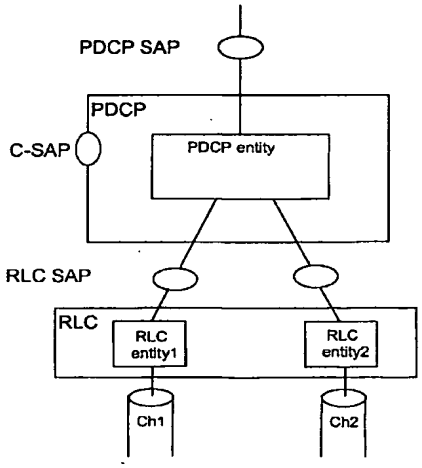

PDCP SAP
PDCP
C-SAP
PDCP entity
RLC SAP
RLC
RLC
entity1
RLC
entity2
Ch1
Ch2

FIG. 3

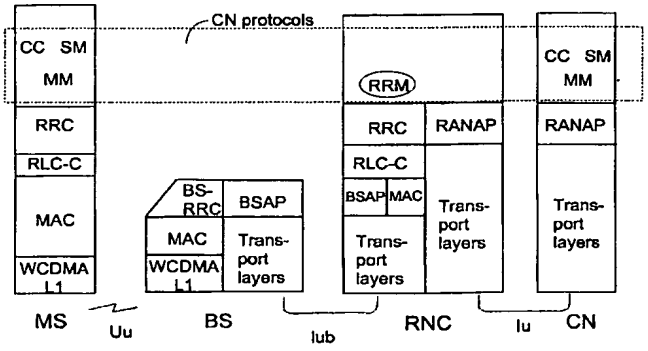

CN protocols
CC SM
MM
RRC
RLC-C
MAC
WCDMA L1
BS-RRC
BSAP
MAC
WCDMA L1
Trans-port layers
RRM
RRC
RANAP
RLC-C
BSAP
MAC
Trans-port layers
Trans-port layers
CC SM
MM
RANAP
Trans-port layers
MS
Uu
BS
Iub
RNC
Iu
CN

FIG. 2a

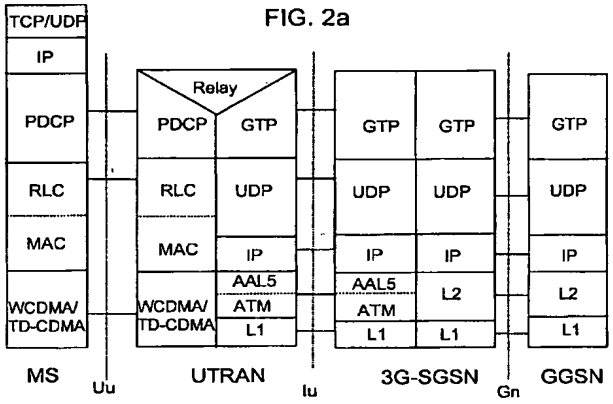

TCP/UDP
IP
PDCP
RLC
MAC
WCDMA/ TD-CDMA
Relay
PDCP
GTP
RLC
UDP
MAC
IP
AAL5
WCDMA/ TD-CDMA
ATM
L1
GTP
GTP
UDP
UDP
IP
IP
AAL5
L2
ATM
L1
L1
GTP
UDP
IP
L2
L1
MS
Uu
UTRAN
Iu
3G-SGSN
Gn
GGSN

FIG. 2b

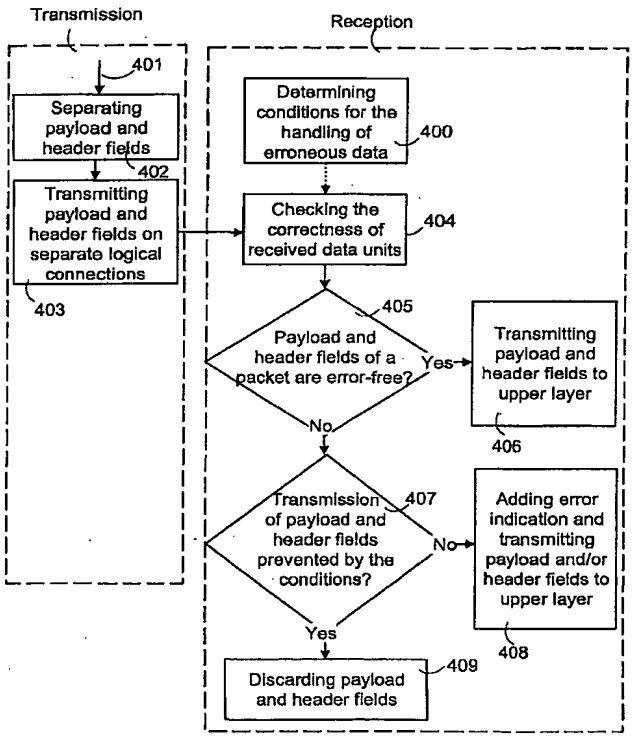

Transmission
Reception
401
Separating payload and header fields
402
Transmitting payload and header fields on separate logical connections
403
Determining conditions for the handling of erroneous data
400
Checking the correctness of received data units
404
405
Payload and header fields of a packet are error-free?
Yes
No
Transmitting payload and header fields to upper layer
406
Transmission of payload and header fields prevented by the conditions?
407
No
Yes
Adding error indication and transmitting payload and/or header fields to upper layer
408
Discarding payload and header fields
409

FIG. 4

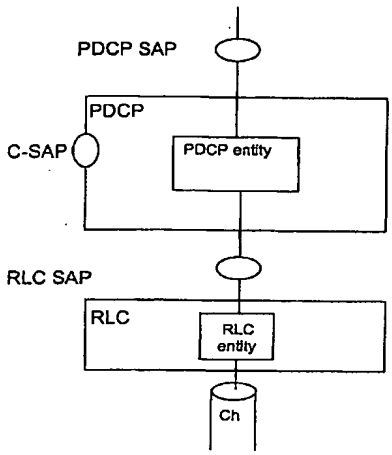


FIG. 5

【手続補正書】
【提出日】平成15年9月16日(2003.9.16)
【手続補正１】
【補正対象書類名】特許請求の範囲
【補正対象項目名】全文
【補正方法】変更
【補正の内容】
【特許請求の範囲】
【請求項１】
パケット交換データの誤り制御を行う方法であって、少なくとも第１部分と第２部分がパケットから分離され、かつ受信データで検出された誤りが検査される前記方法において、誤りの状況で前記第１部分と第２部分の処理に適用する条件を接続設定期間中に選択するステップと、
受信した前記第１部分及び／又は第２部分で検出された誤りに応じて、前記条件が、該第１部分及び／又は第２部分を上位プロトコル層に伝送することを許すかどうかをチェックするステップと、
伝送を許可する前記条件に応じて、前記上位プロトコル層に前記第１部分及び／又は第２部分の伝送を行うステップと，を有することを特徴とする方法。
【請求項２】
前記第１部分はヘッダフィールドから成り、前記第２部分はペイロードから成ることを特徴とする請求項１に記載の方法。
【請求項３】
前記ヘッダフィールドは、前記条件がそのヘッダフィールの、上位層への伝送を止めたとしても、圧縮に使用されることを特徴とする請求項２に記載の方法。
【請求項４】
前記第１部分と第２部分は伝送すべきＩＰデータパケットから分離され、かつ該第１部分と第２部分は別個の論理接続で伝送されることを特徴とする請求項１～３の何れか一項に記載の方法。
【請求項５】
前記伝送すべきパケットの前記第１部分及び／又は第２部分で検出された誤りを前記上位層へ知らせるステップをさらに有することを特徴とする請求項１～４の何れか一項に記載の方法。
【請求項６】
物理層で受信した、前記第１部分と第２部分を含むデータユニットについて誤り検査を行うステップと、
誤ったデータユニットに誤り表示を付加するステップと、
前記データユニットが前記条件を満たすかどうかをチェックするステップと、をさらに有することを特徴とする請求項１～５の何れか一項に記載の方法。
【請求項７】
無線リソース制御プロトコルＲＲＣが無線リソースの管理のために使用される請求項１～６の何れか一項に記載の方法において、
パケット無線ネットワークと移動局の間のＲＲＣシグナリングにより前記指示を決定するステップと、
ＰＤＣＰエンティティ又はＲＬＣエンティティのようなデータリンクエンティティに前記チェックを行うように構成するステップと、をさらに有する方法。
【請求項８】
無線リンク制御層のＲＬＣエンティティによって前記論理接続が処理され及び
誤ったデータを上位層に伝送すべきかどうかを指示する命令を前記ＲＬＣエンティティに与えることを特徴とする請求項４～７の何れか一項に記載の方法。
【請求項９】

パケットデータコンバージェンスプロトコル層のＰＤＣＰエンティティが前記第１部分及び／又は第２部分を分離し、またそれらを合成する責任を負い及び
１つの及び同じパケットの前記第１部分及び／又は第２部分が誤ったという表示に応じて、前記条件がチェックされることを特徴とする請求項１～８の何れか一項に記載の方法。
【請求項１０】
さまざまな条件が、前記論理接続を提供するネットワーク構成要素よりも前記移動局に適用されることを特徴とする請求項１～９の何れか一項に記載の方法。
【請求項１１】
受信パケット交換データで検出された誤りを検査するように構成されかつ少なくとも第１部分と第２部分がパケットから分離されるパケット無線システムにおいて、
前記パケット無線システムは、少なくとも前記第１部分と第２部分で検出された誤りを処理する条件を接続設定期間中に選択するように構成され、
前記パケット無線システムは、受信した前記第１部分及び／又は第２部分で検出された誤りに応じて、前記条件が、該第１部分及び／又は第２部分を上位プロトコル層に伝送することを許すかどうかをチェックするように構成され及び
前記パケット無線システムは、伝送を許可する前記条件に応じて、前記第１部分及び／又は第２部分を上位プロトコル層に伝送するように構成されることを特徴とするパケット無線システム。
【請求項１２】
前記第１部分はヘッダフィールドから成り、前記第２部分はペイロードから成ることを特徴とする請求項１１に記載のパケット無線システム。
【請求項１３】
前記パケット無線システムは、伝送すべきＩＰパケットから前記第１部分と第２部分を分離するように構成され及び
前記パケット無線システムは、別個の論理接続で前記第１部分と第２部分を伝送するように構成されることを特徴とする請求項１１又は１２に記載のパケット無線システム。
【請求項１４】
無線リソース制御プロトコルＲＲＣが無線リソースの管理のために使用される請求項１１～１３の何れか一項に記載のパケット無線システムにおいて、
前記パケット無線システムのパケット無線ネットワークは、移動局へのＲＲＣシグナリングにより前記指示を決定するように構成され及び
前記移動局と前記パケット無線ネットワークは、ＰＤＣＰエンティティ又はＲＬＣエンティティのようなデータリンクエンティティに前記チェックの実行を命令するように構成されることを特徴とするパケット無線システム。
【請求項１５】
少なくとも第１部分と第２部分がパケットから分離されるパケット交換データを転送する手段と、受信データの誤りを検出する手段と、を備える移動局において、
誤りの状況で前記第１部分と第２部分の処理に適用する条件を接続設定期間中に選択する手段と、
受信した前記第１部分及び／又は第２部分で検出された誤りに応じて、前記条件が、該第１部分及び／又は第２部分を上位プロトコル層に伝送することを許すかどうかをチェックする手段と、
伝送を許可する前記条件に応じて、前記上位プロトコル層に前記第１部分及び／又は第２部分の伝送を行う手段と、をさらに備えることを特徴とする移動局。
【請求項１６】
少なくとも第１部分と第２部分がパケットから分離されるパケット交換データを転送する手段と、受信データの誤りを検出する手段と、を備えるネットワーク構成要素において、
誤りの状況で前記第１部分と第２部分の処理に適用する条件を接続設定期間中に選択する手段と、
受信した前記第１部分及び／又は第２部分で検出された誤りに応じて、前記条件が、該第

１部分及び／又は第２部分を上位プロトコル層に伝送することを許すかどうかをチェックする手段と、
伝送を許可する前記条件に応じて、前記上位プロトコル層に前記第１部分及び／又は第２部分の伝送を行う手段と、をさらに備えることを特徴とするネットワーク構成要素。特許請求の範囲が補正された。実際補正がされているのは請求項１，１１，１５及び１６項のみである。

【国際調査報告】

INTERNATIONAL SEARCH REPORT

International application No.
PCT/FI 02/00029

A. CLASSIFICATION OF SUBJECT MATTER

IPC7: H04L 1/00, G06F 11/00, H04L 29/06, H03M 13/00
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC7: G06F, H03M, H04L

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-INTERNAL, WPI DATA, PAJ, INSPEC, COMPENDEX

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
E,X	US 2002015405 A1 (SEPPONEN,R. ET AL), 7 February 2002 (07.02.02), sections 0008-0011, 0023-0025, 0028-0031, 0053-0059 --	1,11,15,16
P,X	US 2001007137 A1 (SUUMAKI,J. ET AL), 5 July 2001 (05.07.01), sections 0040-0044, claims 1-6 --	1,11,15,16
X	WO 0076112 A1 (LUCENT TECHNOLOGIES INC), 14 December 2000 (14.12.00), page 2, line 18 - page 3, line 18; page 9, line 3 - page 12, line 24, abstract --	1,11,15,16

[X] Further documents are listed in the continuation of Box C. [X] See patent family annex.

* Special categories of cited documents
"A" document defining the general state of the art which is not considered to be of particular relevance
"B" earlier application or patent but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
29 April 2002	30 -04- 2002
Name and mailing address of the ISA/ Swedish Patent Office Box 5055, S-102 42 STOCKHOLM Facsimile No. +46 8 666 02 86	Authorized officer Marianne Norrgren/LR Telephone No. +46 8 782 25 00

Form PCT/ISA/210 (second sheet) (July 1998)

INTERNATIONAL SEARCH REPORT

International application No.
PCT/FI 02/00029

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO 9952307 A1 (TELEFONAKTIEBOLAGET LM ERICSSON (PUBL)), 14 October 1999 (14.10.99)	1-16

Form PCT/ISA/210 (continuation of second sheet) (July 1998)

INTERNATIONAL SEARCH REPORT

Information on patent family members

28/01/02

International application No.
PCT/FI 02/00029

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2002015405 A1	07/02/02	WO 0201784 A	03/01/02
US 2001007137 A1	05/07/01	AU 2377601 A	16/07/01
		FI 992837 A	01/07/01
		WO 0150789 A	12/07/01
WO 0076112 A1	14/12/00	AU 4307400 A	28/12/00
		EP 1059755 A	13/12/00
		EP 1183811 A	06/03/02
WO 9952307 A1	14/10/99	AU 3857199 A	25/10/99
		CA 2326750 A	14/10/99
		CN 1304619 T	18/07/01
		EP 1066729 A	10/01/01
		US 5923592 A	13/07/99
		US 6122211 A	19/09/00

Form PCT/ISA/210 (patent family annex) (July 1998)

フロントページの続き

(81)指定国 AP(GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZM, ZW), EA(AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), EP(AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE, TR), OA(BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG), AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, OM, PH, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VN, YU, ZA, ZM, ZW

(72)発明者 トウルネン, アリ
フィンランド国, エフイーエンー０２２３０ エスポー, レイリティエ 1 デー 36
(72)発明者 カッリオクルユ, ユハ
フィンランド国, エフイーエンー３７４７０ ベシラーティ, ヨキオイステンティエ 5

Fターム(参考) 5K014 AA01 BA01 FA02 FA09
5K034 AA05 CC02 CC05 EE11 FF02 GG03 HH07 KK27 MM01 SS02